THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS

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CLEVELAND, O., APRIL 9, 1891.

THE WEEK IN IRON CIRCLES.

General Features. One important element of encouragement that is beginning to give an undertone to the iron trade generally is the crop prospect. The Winter has been very favorable to wheat throughout Ohio and in the Western States. The stand was never better at this season, and the acreage is very large. The retarded Spring also gives promise of a heavy fruit crop. These influences are imparting a firmer tone to railroad operations, and our information is that good-sized orders for equipment will shortly be placed. The tone of the Cincinnati market is dull and firm. Values are already so low that further concessions seem impossible. Buyers everywhere seem to think that as soon as the coke strike is settled, there will be a large increase of production and prices must go lower. Some experienced iron men look for just the opposite effect. For two months purchases have been withheld largely for this cause, and it is thought that when the strike is settled more free buying will begin, and as it will find very low stocks, the actual effect may be to stimulate rather than depress prices. It is true that consumption has been considerably reduced, but not so much as production. Transactions have been namely for small lots during the week, but the aggregate is pretty fair. While business at Detroit continues dull, and for the most part is confined to small orders, yet some few are being booked for quantities ranging from 300 to 500 tons, and occasionally one as large as 1,000 tons is secured. Notwithstanding these few bright spots, the market generally is considered a dull one. The call for foundry iron is not very great, and the majority have contracts running for some months yet. The orders received are for prompt shipment. The impression is very general that prices on coke iron cannot well advance and buyers feel pretty secure in waiting, as they think when the Valley furnaces get to blowing again, there will be a surplus of foundry irons, and prices on Southern iron will fall back to figures made some months ago, and possibly a shade lower. Lake Superior charcoal is generally conceded to be as low as it can be produced, and if any change is made it must be to a higher basis. The Chicago market still shows the same conditions which prevailed a week ago. The amount of business going is light, orders to a large extent consisting of carload lots. Inquiries continue to be mainly for small quantities and near-by deliveries, but a few of the large consumers of the Chicago district have endeavored to find job lots at special cut figures. The amount of Southern coke iron pressing the market for sale, however, is small, Chicago furnaces being well supplied with contracts for the present. There has been no change in Lake Superior charcoals, and the present outlook, however, does not point to any stiffening of values in this line. The consumption of iron continues to run light, many of the jobbing foundries reporting that business has fallen largely off, but manufacturers of specialties are running full, with but few exceptions. The St. Louis market remains unchanged, although there were one or two large transactions during the past week. Buyers and sellers display an indifference, however, to large orders at the prices now current. As production has been light, especially among the Northern furnaces, there is no disposition on part of sellers to shade the figures that are already low. The Louisville market has been very quiet, and but a small amount of iron sold. There have been a few sales of close silver grey, on the basis of $10.75, furnace, one sale of about 4,000 tons, on the basis of $10.00 for grey forge, Birmingham. Twelve hundred tons of Birmingham grey forge was offered at a shade under $10, and only a portion of it taken. The same, however, was for prompt delivery and prompt cash, and was made by a furnace out of blast who wished to close out iron in yard. Southern car wheel iron is slightly better, and a sale was made fully 75 cents over what the same quality of iron had been sold in November, the price being in the neighborhood of $20, Louisville. The same, however, is yet very low, and producers claim that they but get the cost of making. At Buffalo there have been no new developments during the past week. Dullness is the principal feature, and there are no indications of any great activity in the future. Prices remain about the same, with a business which is confined to orders for immediate requirements only.

The Local Situation. While there is no immediate change in the situation, the prospects favor some new developments, and it is not unlikely that a radical change of some sort may be inaugurated very suddenly. The coke situation is just about where it stood a week ago, as to production. The disturbances at the ovens will make it impracticable to resume active operations in full force, at least for a week or two to come, and even after a resumption of work, the coke turned out will go mostly to the Carnegie furnaces, and to the foundries which, at this time, seem to be in particular want of coke. In any event, the furnaces will not be ready to start up, even if they were inclined to such a course, since no settlement has been made of the question of rail freights, with little prospect of an early agreement of this kind, until the return, from the South, of of President Newell, of the Lake Shore road, without whom the Pennsylvania people seem indisposed to make any definite terms. Besides, there appears to be a steady shrinkage of prices as the stocks are dwindling down, so that it may well be said that the less iron there is, the cheaper it is. The furnacemen in the valley are not a little wrought up over the action of a Girard concern, owned by Pittsburgh parties, which, despite the agreement of the Mahoning Valley Association, has gone into blast again. The managers of this concern were among the most active in bringing about the shut-down, last December, having then on hand a matter of 20,000 tons of pig metal, which they have since disposed of at a better price, naturally, than they could have obtained for it, had not all the iron firms in the valley shut down. Just how the other furnace firms look at this matter, appears from a recent meeting of the association, in which some very peppery resolutions were adopted, concerning the breach of faith on the part of the Girard firm, the proprietor and general manager being disqualified from further membership. Rumors have been thick during the week as to sales of ore, but on close inquiry it is found that one house, several weeks ago, disposed of a very small lot of Minnesota ore, for Eastern shipment, and there has been sold a little third grade Champion ore, known as Suffolk. The report of a large sale of Norrie ore to the Illinois Steel Company is authoritatively denied by officers of that concern, who happen at the same time to be interested in a Cleveland ore firm, so that there is very little doubt on the subject in local circles. Nobody expects much in the way of ore movement until well into June, or the beginning of July. The vessel interests also are opposed to any early opening of navigation, and no charters of any kind are reported so far for the ore trade, both ore men and vessel brokers preferring to take their chance when the season shall warrant some commensurate action. As it is, about one half the lake fleet has signified an intention to remain out of commission until the middle of May, and the chances are very good that the larger part of these will manage to keep out until the first of June, thus saving a considerable amount in the cost of maintenance, and 15 per cent. of the amount of their marine insurance. Everything is in a highly unsettled condition, which proves unsatisfactory to all the lines concerned, and which, moreover, shows no signs of an early abatement.

IRON AND THE MONEY MARKET.

The present depressed condition of the pig iron market is so closely allied to the financial stringency that a brief survey of the monetary situation may be of interest at that time. The *American Banker*, whose utterances are always marked by intelligent conservatism, presents several reasons for the belief that the worst is fully over, and that the immediate future is one of encouragement. It shows, in the first place, that there is no doubt that, during the last few weeks, formidable causes of danger have passed away, and that the prospects are brightening in many parts of the financial horizon, both at home and abroad. In the second place, in view of the general improvement in the activity of productive enterprise, it is observed with much satisfaction that the drain on the bank deposits of the central cities has not been quite as active as was anticipated, and that the bank reserves of the New York Clearing House show a very gratifying elasticity and strength. The same conservative accummulation of the metallic reserves is visible in the Treasury. The free gold balance is augmenting, notwithstanding the recent specie exports, and shows a stronger undertone of elasticity than for some time past. Concerning the loan market, the *Banker* says:

As the rates for money in the early future, the general situation offers good evidence that in view of recent perils, the loan market will continue to work with conservative discrimination, but will for the most part, show a tendency, both in rates and otherwise, to favor good borrowers while rigidly scanning collaterals. For the opinion that money will work easier several reasons have been offered. First, the deposits are already showing an active tendency to accummulate in all the reserve cities. Since the panic when this movement began some notable changes have been started, especially in the relations of the country banks. Comptroller Lacey's reports for December 19, 1890, and February 26, 1891, give many illustrations of this. Some of the facts are both instructive and novel.

The December report shows how the country bank deposits in the reserve cities were depleted, and the February report shows the reaction. In New York, they fell to $152 76 millions in December, during the panic, recovering to $175.02 in the following February, when the spasm was over. At Chicago, these country bank deposits fell to $39 65 millions in December, recovering to $48 87 in February. We have compiled the records of thirteen of these reserve cities, and we find that the aggregate of their deposits from corresponding banks fell in December to $291.99 millions, and had increased in February to $338 16, showing a total accumulation of $46 17 millions. But what has this to do with our present money market? Simply this. It illustrates the argument that a further similar accumulation of deposits from like causes will occur again, and that in the banks of New York and other great central cities as well as throughout the country, this flood tide of currency and deposits will rise, so that the banks will have plenty of money to lend, and the usual easy working of the loan market will thus be assured. In regard to this view it is pointed out that during the interval covered by the December and February reports, just given from Comptroller Lacey, the loans of the New York banks were expanded $16.12 millions; those of Chicago $3 53 millions, and the aggregate loans of the thirteen cities increased $16.26 millions, while their total reserves increased $18 56 millions.

The conclusions reached from these movements of currency are, first, that, after the panic, the individual deposits tended to decline, and secondly, that the contemporaneous increase of the country bank balances in the central cities aided the general recuperative movement. If, as is predicted, a similar accumulation of money will tend from all parts of the country to flow into the banks of New York, and the other great central cities, the prospects of monetary ease will certainly be augmented. The iron interests will certainly hail such indications with delight.

COBDEN'S PROPHECY AND CANADA'S COMMENT.

Mr. Cobden prophesied that the adoption of Free Trade by England would undoubtedly be followed by the general acceptance of the principle by all nations within 10 years; but after 38 years of British Free Trade Mr. John Bright admitted that through it "the agricultural classes of Britain had lost more than 150,000,000 pounds sterling." Truly, under her non-protective system Britain is losing her supremacy in manufactures, trade and navigation; and she is no longer queen of the realms of commerce, mistress of the seas or creditor in chief of the human race. Her Free Trade policy has done it.—[Canadian Manufacturer.

Well, well, if that is "treason," make the most of it. That it is a fact, there can be no doubt. But to have the fact stated so frankly, so clearly and so emphatically, and that by a leading Canadian journal, an able advocate of the National Protective Policy of that country, and a vigorous supporter of the present Tory Government, is refreshing, to say the least. Beyond question Great Britain has lost immensely through Free Trade, and not the least among her losses may be that of the prosperous, intelligent and liberal-minded people at the north of us. That Canada will ever become an integral part of the United States we very much doubt. Indeed, we fail to see the desirability on either side of such union. But we do sometime look for a complete separation from the Mother Country, politically as well as commercially; and no surer way of bringing about this result can be had than that of building up on this continent a people whose prosperity comes from a policy totally at variance with that of Great Britain.

THE READING REACHING FOR THE LAKE TRADE.

The important railroad news of the week is the announcement that the Reading system has gained entrance to the lake trade through the port of Ashtabula. As the story goes, the acquisition of the Beech Creek road by the Vanderbilts, has rendered possible a new route from Philadelphia to Chicago, 100 miles shorter than the present route via Lyons and the New York Central road. The Vanderbilts are to construct ninety miles of road, from the western terminus of the Beech Creek to Oil City, where connection will be made with the Lake Shore road, thus forming the through route. At Ashtabula, docks are to be erected over which the Reading will ship coal for Lake Superior points, and vessels will discharge cargoes of iron ore to be delivered to furnaces in the Reading's territory. All rail freight to Chicago and other points on the Vanderbilt western system will also go over this route instead of the present one. Another contract will be made between the Reading & Fall Brook and New York Central companies, covering the business with Central New York and Buffalo. The Reading has recently purchased a coal storage plant at Buffalo, with a capacity of 350,000 tons, and intends to place more coal in the Western anthracite market than before.

This means, of course, a new boom for Ashtabula, already the largest ore-receiving port on the lakes. In 1889 Ashtabula received, according to the census, 2,199,109 tons of iron ore, constituting 28.84 per cent. of the total receipts at all lake ports. This important addition to its commerce means much for its future development, as it also signifies an increasing Eastern market for Lake Superior iron ore.

CONCERNING our recent comments on the coke situation the *National Labor Tribune* has this to say:

The Cleveland *Iron Trade Review* has had prepared by an expert of the coke market the following article on the Connellsville situation. It will be observed that this expert takes no stock in the newspaper assertions that the strike will end in a very short time. He agrees with what the *Tribune* has said as to many "labor items" of this character, namely, that such were prepared either without knowledge of the essential facts, or with the object to bring about a defeat of the workmen. The *Tribune* does not agree with all set forth in the following, but it does agree with the assertion that the strike has not yet been broken, and further that with the very general and enthusiastic disposition to push the 1st of May reform project, the probabilities are in favor of the workmen. The fact is, the only apparent obstacle to their success is that abomination, the non-unionism of men in regions which compete more or less with Connellsville. The most potent enemy to satisfactory wages and terms in all crafts is the non union element.

THE resumption of Southern furnaces goes steadily forward. Two additional stacks blew in last week, making in all 27 active furnaces in Alabama at present, representing nearly two-thirds of the producing capacity of the State. The Southern makers feel very confident in their position, being protected by their railroads against any reduction in freight that may be made in the North. In the meantime, the sale of Southern iron in Northern markets increases. A recent estimate shows that of the 600,000 tons of pig iron sold annually in the Chicago market, 200,000 tons came from Southern furnaces. Just how long this active competition will keep up remains to seen, but in the inevitable readjustment of wages there must sometime come a cessation of the steady flow of Southern iron Northward.

IN a recent lawsuit, a drummer defined his duties as going out "to see a man and talk him helpless, make him smoke cigars that he doesn't want, and drink wine that he doesn't care for, and bore him a day, or a week, if necessary, and bore yourself as well, until finally, just to get rid of you, he gives you an order." If that is his best conception of the duties of a traveling man, it is no wonder he gets into litigation with his employers. The fellow that would get trade in that way deserves to be landed in the middle of the street, without further ceremony. The best type of outside representative doesn't get trade that way.

OUR friends of the *National Car and Locomotive Builder* have good cause for agony of soul in the following:

Many of our exchanges display great carelessness about treating us to our full name since the change was made. We are touchy about the correct appellation of this journal being given, and endure the keenest torture when we are spoken of as the *Master Car Builders' Journal*, the *Locomotive and Car Gazette* and the various other diversities that inaccurate memories put upon us. But the *Iron Trade Review* has filled up the cup of our bitterness to overflowing by crediting an article taken from our columns to the *Natural Gas and Locomotive Builder*.

THE IRON ORE DEPOSITS OF AUSTRALIA.—II.

BY U. S. CONSUL GRIFFIN, OF SYDNEY.

There are various other kinds of iron of more or less commercial value found throughout the colony. Chrome iron exists in abundance at Tamworth and on the Gwydir River and its tributaries; also at Gordon Brook, Armidale, etc. At Tamworth there is a vein of chrome iron 40 feet thick, specimens of which showed, upon analysis, 64 72 per cent. of chromium sesquioxide and 21.11 per cent. of iron protoxide. Professor Liveridge states that this vein could be easily and profitably worked. The chief obstacle, however, to the working of chromium, or, indeed, of any other kind of iron in the colony, is the high cost of labor.

Rich seams of magnetic iron ore are found at the iron-stone mountain, Port Stevens, where there is a magnificent harbor, 80 miles northeast of Sydney. Mr. T. W. E. David, Government geological surveyor of New South Wales, has recently made an interesting and valuable report on the Port Stephens iron-stone mountain. He states that the prospecting board have made a number of openings for the purpose of following the ore bed in straight to the dip. The extent of the dip has not yet been defined. The samples obtained from it show a large percentage of metal. These, however, were obtained from the outcrop, which are usually somewhat richer in iron than those taken from a depth, owing to the iron in the surface ore having become concentrated through the action of the weather, which leads to a constant dissolving and reprecipitation of iron near the surface. In this process the impurities of the ore (sand, clay, etc) follow it a short distance down toward the dip, and, consequently, enrich it. The report says:

"There is a fall of between 300 and 400 feet from the various outcrops of the iron-stone bed here to sea-level. The greater part of the country intervening between the iron-stone mountain and the Karua wharf is either flat or undulating, becoming rocky and broken until in the immediate vicinity of the iron-stone. There is abundance of good timber in the locality, so that there would be little difficulty in constructing a tram line or railway line from the mountain to the Karua river. The formation in which the iron-stone occurs is the "rhacopteris beds," which are probably of lower carboniferous age, and are certainly older and underlie the Greta coal-measures, and have never yet themselves been proved to contain productive coal seams. The outcrop of the bed was traced by me for over a quarter of a mile, being bounded on the north by an intrusive felstone, while to the south it apparently thins out. It is more than probable that the prospecting trenches will prove it to extend still further in this direction. It is also nearly certain that its continuation still further north will be discovered on the north side of the dike of felstone, as the same bed of iron ore is known to occur at Bowral and to the west and east of Stroud, the bed dipping under Stroud from the west, then rising again to the surface to the east of Stroud, so that it lies in a complete trough or basin. A partial section of the bed, in two places where it is obtainable in trenches already cut, shows that its thickness varies from three to four feet. The d p is southwesterly at from 20° to 30°. Assuming that the bed maintains an average thickness of three feet for a distance of, say, a quarter of a mile in the dip, and that the average yield of ore is, say, one-quarter less than it is at the surface, the total quantity of metallic iron here would be, roughly, 800,000 tons, equal to 5,000 tons per acre. This estimate is, of course, only very approximate, and is subject to correction when a truer estimate can be formed upon the completion of the present prospecting operations. At the iron-stone mountain the ore bed dips towards the west, but at a short distance to the west the dip changes persistently to the east, so that the iron ore should rise to the surface again in this direction, and it would be advisable to prospect here for its western outcrop."

The report further states:

"The iron stone mountain is interbedded with thick masses of volcanic sandstone (arkose), composed of tufaceous material ejected during volcanic eruptions, intermixed with sand. The ore bed has evidently been formed by the mechanical concentration of the minute crystals of magnetic iron contained in the tufaceous sandstone by the agency of sea-water acting on a beach, which has thus produced a beach wash of magnetic iron-sand of lower carboniferous age, similar to that which is at present being formed at Taranaki, in New Zealand. That this is the true origin of this bed of iron ore is also proven by the presence of titanic acid, the analysis showing that there is as much as 7.30 per cent. of titanic acid present, which is equal to from 16 to 17 per cent. of titaniferous iron. The analysis by Mr. J. C. H. Mingaye, F. C. S., shows that there is 18.70 per cent. of silica and 5 28 per cent. of alumina present. The presence of so much silica would certainly make the ore a refractory one to smelt, and its treatment would be rendered still more difficult by the presence of so much titaniferous iron. There is, however, a considerable quantity of earthy limestone and a small bed of pure limestone close to the deposit of magnetic iron-stone, and this would serve as a flux should it be decided to attempt to smelt the iron-stone on the ground. The value of this deposit will depend on (1) its yield of metallic iron at a depth (this will be proved by the analysis hereafter to be made of the ore at a depth as exposed in the ends of the cutting, for which aid has been granted out of the prospecting vote); (2) its average thickness, as will be proved by the trenches, for which similar aid has been given; (3) on the possibility of smelting successfully an ore which contains so much silica and titanic acid, so as to produce from it a marketable quality of iron."

The richness of New South Wales iron ores has been for a long time well known and acknowledged by experts; but the high cost of labor, as previously mentioned, is a serious obstacle in the way of working the deposits economically, and then, in addition, there is the heavy expense connected with the erection of smelting works. Moreover, the value of iron, on account of its bulk, is small when compared with that of other metals; but, notwithstanding these obstacles, several syndicates have been formed here and in England for the purpose of working the ores. Mr. J. Mitchell, member of the New South Wales Parliament, who visited England at the beginning of the present year, has just succeeded in forming a syndicate in London for the purpose of working the ores at Wallerawang and Wollongong. Mr. Mitchell states that much of the ores at those places is richer than that imported into England from Spain. When iron works were first started in New South Wales, the cost of coal at the mines was $15 per ton. It can be obtained at 97 cents per ton now. Mr. Mitchell says that no aid will be required from the Government, either by bonuses, import duties, or privileges of any kind whatever, and that the usual colonial rate of wages will be paid to the miners.

Mr. Mitchell, while in Europe, secured the services of a Scotch iron expert for the purpose of reporting upon the iron-making capabilities of New South Wales. This expert, after visiting all the principal places where iron is found, reported very favorably in regard to them. He said that he was fully satisfied that iron could be manufactured at a profit without reducing wages or interfering with the eight-hour system. He does not, however, advise the investment of capital in the industry until a better understanding can be arrived at between capital and labor than at present exists in Australia. There are, however, many here who contend that, leaving the labor question out altogether, it will be impossible to manufacture iron and steel without the assistance of an import tax, which, it is said, should not be less than $9.73 per ton. Through the help of the duty on wire netting ($7.30 a ton) the colony is enabled to manufacture no inconsiderable portion of the wire used here for fencing. It is also claimed that, if this duty were removed, the price of netting would be at least 25 to 30 per cent. higher than it is. The fact is often cited that when bar iron is worth only $38.88 per ton in London, it can not be purchased in Sydney for less than $63. It is contended that the freight charges are light, and that there is no just reason why the article should command such a high price in a free port. Plates are quoted in London at $38 88 per ton; the quotation here is from $65 44 to $68, and it is said that these prices would not be exceeded if the articles were made here. It is also said that an enormous iron and steel industry has sprung up in the United States that has no parallel in the world, chiefly through the exaction of import duties, which have so cheapened the product that the country is not only able to supply her own wants, but those of her neighbors.

A TREMENDOUS HAMMER.

The hammer shop now in process of completion at South Bethlehem, Pa., will probably be regarded as more remarkable for evidence of power than any mechanical contrivance yet constructed by man, says *Harper's Weekly*. It is here that the plates are to be prepared for our growing navy. This building includes furnaces and a vast tank for tempering the plates. They will be lowered into it by traveling cranes. The tank is divided into compartments, enabling several plates to be treated at once.

The hammer is, however, the most marvelous object in the hammer shop. It was designed by John Fritz, chief engineer and general superintendent, who has been connected with the works from the beginning, and has invented or improved many of the appliances in use at South Bethlehem.

In the designs for the hammer proper Mr. Fritz consulted the plans of Le Creuzot, following them as far as they met the conditions of construction already adopted. The entire foundation of the hammer room is actually laid on what two years ago was the bed of the Lehigh river, which was deflected from its course, and the anvil and hammer frame rests on piles. Above these a mass of cyclopean masonry has been built, and upon that the anvil is superimposed, consisting of a bed of solid iron capped by a bed of steel. This anvil represents the trifling amount of 1,400 tons of solid metal. Over the anvil springs the colossal frame which supports the hammer. This frame bears a certain resemblance in shape to a truncated tower at Eiffel. It springs to a height of 90 feet from a spreading base whose foundations are clamped deep in the earth. This huge structure contains 475 tons of iron.

The tap of the hammer is a square solid block of iron faced with steel. It runs in a groove, like the hammer of a spile driver, is raised by steam, and has a hoist of 18 feet. It weighs 125 tons. The total weight of iron in this stupendous hammer, frame, and anvil reaches the enormous sum of 2,000 tons. One can perhaps more clearly realize what the direct p'unge of weight of 125 tons means if he considers that it is equal to the weight of two regiments of soldiers, or 3.700 men, but having even more impetus, because concentrated in a solid mass of so many cubic feet. It is with this mighty engine that the armor plates of our ships of war are to be forged.

Our Trade With Canada.

The following statement shows the volume of trade between the United States and Canada for the fiscal year 1889 90, as furnished by the book-keepers for both countries:

	Exports.	Imports.
United States	$60,499,000	$39,000,000
	Imports.	Exports.
Canada	$52,300,000	$40,500,000

According to our accountants, the whole volume of trade was $99 499 000; according to Canadian statisticians it was $92,800,000. Both statements concur in showing a heavy balance of trade in favor of the United States. The disparity of $8,000,000 in the statement of our exports as compared with the Canadian statement of imports is not at all astonishing. If there could be any way of getting at the extent of undervaluations, and the smuggling going on along a line of 3 000 miles of land and water frontier, the sum total of our interchanges would be much enlarged.—[Philadelphia Record.

"CRUSHED steel," made by quenching carbon steel at a very high temperature in cold water, is being used for cutting stone. This makes it so brittle that it can be pulverized in a stamp mill.

CENTRAL IRON FREIGHTS.

At the meeting of the Central Traffic Association, held in Chicago, the Freight Committee agreed that the rates on articles of manufactured iron and steel be made between the points in the territory of that association on the basis of 17½ cents per 100 pounds, less than carload lots, and 15 cents per 100 pounds, carload lots, from Pittsburgh to Chicago, to take effect March 30, but not to extend beyond August 31, 1891. The territory of the Central Traffic Association includes Buffalo, N. Y; Salamanca, N. Y; Pittsburgh, Pa; Wheeling, W. Va., and all points West of those cities. In accordance with the above, the fifth and sixth class rates, per 100 pounds, on articles of iron and steel manufacture from Pittsburgh to points given below, are as follows:

Pittsburgh to—	Less than ca load lots.	Carload lots.
Chicago	$0.17½	$0.15
East St. Louis	.22	.18½
Cincinnati	.15	.12
Columbus	.11	.09
Louisville	.19½	.16
Cleveland	.09	.08
Indianapolis	.15	.13

The rate per 100 pounds on the same articles from the Mahoning and Shenango valleys, to the points named below, will be as follows:

Mahoning and Shenango valleys to—	Less than carload lots.	Carload lots.
Chicago	$0.15	$0.13
East St. Louis	.20	.16½
Cincinnati	.13	.10
Louisville	.17½	.14
Indianapolis	.14	.11
Cleveland	.04½	.04
Columbus	.09	.08

On and after March 30, 1891, the rate on pig iron from Pittsburgh to the Mahoning and Shenango valleys will be 70 cents per gross ton, instead of 80 cents. Between the same points the rate on muck bar, scrap iron, billets, blooms and skelp iron will be 85 cents per gross ton, instead of 95 cents. Between the same points the rates on cinder and scale will be 65 cents per gross ton, instead of 70 cents. On and after the same date the rate on pig iron from Rankin Station, Pa., to the same points will be 85 cents per gross ton, instead of 95 cents. On the same date the rate on muck bar, scrap iron, billets, blooms and skelp iron will be $1 02 per gross ton, instead of $1.12.

The rate on cinder and skelp iron between the same points will be reduced from 87 to 82 cents per gross ton. From Braddock, Bessemer and McKeesport, Pa., to the Mahoning and Shenango valleys the rate on pig iron will be reduced from 95 cents to 85 cents per gross ton. Between the same points the rate on muck bar, scrap iron, billets, blooms and skelp iron will be reduced from $1 15 per gross ton to $1.05 per gross ton, and between the same points the rate on cinder and scale will be reduced from 90 cents per gross ton to 85 cents per gross ton.

The Freight Committee agreed that the minimum rates named herein on pig iron and other articles named in the following list, in carloads of 12 tons or over, from and to the points specified, take effect on March 30, 1891, but not to extend beyond August 31, 1891:

Per Gross Ton.—Pig iron, spiegeleisen, manganese ore, muck and puddle bars, iron and steel blooms and billets, scrap iron, scrap steel, scrap tin, borings, old rails, old car wheels and axles, wire rods, and mill and cinder scale.

Per Net Ton.—Molding sand and cast iron pipe.

From / To—	Buffalo, N. Y.	Pittsburgh, Pa.	Mahoning Valley, O.; Shenango Valley, Pa.	Cleveland, O.	Hocking Valley, Moxahala, Shawnee, O.	Zanesville, O.	Columbus, O.	Jackson, Wellston, O.	Ironton, Ashland, Hanging Rock, O.	Detroit, Mich.
Chicago, Ill	$2 50	$2 50	$1 00	$1 80	$2 00	$2 00	$1 80	$2 00	$2 00	$1 60
East St. Louis, Ill	3 00	2 85	2 35	2 35	2 40	2 40	2 20	2 40	2 40	2 15
Louisville, Ky	2 75	2 60	2 20	2 20	2 00	2 00	1 80	2 00	2 00	2 15
Jeffersonville, Ind	2 75	2 60	2 20	2 20	2 00	2 00	1 80	2 00	2 00	2 15
Peoria, Ill	2 75	2 75	2 25	2 25	2 25	2 25	2 05	2 25	2 25	2 15
Detroit, Mich	1 35	2 00	1 60	1 20½	1 40	1 40	1 20	1 60	1 50	.....
Indianapolis, Ind	2 20	2 00	1 60	1 60	1 40	1 40	1 20	1 40	1 40	1 60
Cincinnati, O	2 15	1 80	1 40	1 40	1 20	1 20	1 10	1 00	1 00	1 60
Columbus, O	1 90	1 70	1 30	1 20	75	75	.....	1 00	1 00	1 50
Toledo, O	1 35	1 75	1 35	1 10	1 30	1 30	1 10	1 50	1 50	75
Joliet, Ill	2 50	2 50	2 00	1 80	2 25	2 25	2 05	2 25	2 25	1 60
Fort Wayne, Ind	2 00	2 00	1 60	1 40	1 60	1 60	1 40	1 60	1 60	1 40
Logansport, Ind	2 50	2 20	1 80	1 60	1 80	1 80	1 60	1 80	1 80	1 50
Lafayette, Ind	2 50	2 50	2 00	1 80	2 00	2 00	1 80	2 00	2 00	1 60
Terre Haute, Ind	2 50	2 50	2 00	1 90	1 90	1 90	1 70	1 90	1 90	1 80
Vincennes, Ind	2 75	2 70	2 20	2 20	2 00	2 00	1 80	2 00	2 00	2 15
Evansville, Ind	3 00	2 85	2 35	2 35	2 35	2 35	2 15	2 35	2 35	2 35
Grand Rapids, Mich	2 50	2 50	2 00	1 80	2 00	2 00	1 80	2 00	2 00	1 60
Jackson, Mich	2 00	2 00	1 75	1 55	1 75	1 75	1 55	1 85	1 85	.....
Lansing, Mich	2 10	2 25	1 90	1 70	1 90	1 90	1 70	2 00	2 00	.....
East Keokuk, Ill East Hannibal, Ill East Louisiana, Ill East Burlington, Ill Quincy, Ill	3 25	3 25	2 75	2 50	2 75	2 75	2 55	2 75	2 75	2 50
Springfield, O	2 15	1 80	1 40	1 30	1 10	1 10	75	1 00	1 00	1 50
Dayton, O	2 15	1 80	1 40	1 30	1 10	1 10	90	1 00	1 00	1 50
Richmond, Ind	2 20	2 00	1 60	1 60	1 30	1 30	1 10	1 30	1 30	1 60
Cleveland, O	1 20	1 25	.....	.....	1 30	1 10	1 10	1 50	1 50	1 20
Cairo, Ill	3 25	3 25	2 85	2 75	2 60	2 60	2 40	2 50	2 50	2 75

It was further agreed that notices should be printed in tariffs of the railroad companies limiting the duration of these rates as above.

Magnetized Steel Plates.

Some experiments recently made in the magnetization of steel plates, gave some curious results, by showing that poles could not be formed at right angles to the plane of the disc, but the poles formed were arranged as if the magnetizing force had acted along a diagonal line across the plate, if the plate was square; but if the plate was oblong or a rectangle, the poles formed were parallel with the longer sides. A number of these plates were placed together and magnetized. So long as they remained together a regular distribution of magnetism existed, but when separated, the polarity indicated that the magnetism was along the diagonal. These experiments may serve to explain the irregular records of some testing instruments that have been used extensively —[The Stationary Engineer.

THE FUEL GAS BUSINESS.

The latest trap to catch dollars is in the fuel gas process, and it is being as extensively used as electricity was some four years ago. One of the gas papers says:

"The gas company has introduced the wood-gas process in connection with its works. The claim made for this process is that one cord of dry wood and 300 gallons of crude Lima oil will produce 60,000′ to 80,000′ of gas of 20 to 30 c. p., with a residue of nearly two barrels of fine tar and 65 bushels of merchantable charcoal."

This is the sort of argument that is used to induce persons to invest in gas works, and it is certainly quite attractive on its face. At market rates, the cost of the material to produce the gas, charcoal, and "nearly two barrels of fine tar," is about $13, while the manufactured product is worth $300. This is surely a fine bait, but nothing is said about the cost of production, which is probably so little that it need not be taken into account.

We suspect, however, from what we read in another part of the same paper, that there are drawbacks to even such promising schemes as that briefly mentioned above. A superintendent of a gas works says:

"In the use of illuminating gas for fuel there opens a wide field, just beginning to be understood. There will be a very large demand for gas for fuel, but the fuel gas business will not revolutionize the heating business, as enthusiasts would have us believe; and this is so because of cost. If a person burns 10 tons of coal during a Winter to heat his house he will apply 260,000,000 heat units to this purpose. To obtain this heat from illuminating gas of 20 c. p., at 700 heat units per foot, would require 370,000′; if from fuel gas, of 320 heat units per foot, it would require 812 000′—the waste heat going to the chimney would be substantially the same in either case. With coal at $6 per ton, the cost would be $60; with illuminating gas at $1 per 1,000′, the cost would be $370; and with fuel gas at 50 cents, $406. The extra cost is so excessive that no one seriously thinks of house heating or of steam boiler heating by a distributed gas."

Thus it appears that while we apparently get something for nothing in the first instance ($1,300 for $13), in the last instance we do not get it at all. We may only think we do. To some this might be satisfactory, but the majority, who may have been induced to invest in fuel gas works on the basis of glittering statements, may possibly feel that they have been swindled.

There are very few gold mines extant in promoting stock companies of any sort at the present day. When there are genuine veins the fact is not advertised extensively. The public is not invited to share in the profits of companies which divide 40 and 50 per cent. upon an investment of 25 cents on the dollar.—[The Engineer (New York).

Saving up for the World's Fair.

Many people are already making preparations to attend the World's Columbian Exposition at Chicago, in 1893. This is indicated by the fact that in some parts of the country "World's Fair Clubs" are being formed with the object of accumulating sufficient funds to defray the traveling and other expenses of members when they shall attend the Fair. Newspapers received at Exposition headquarters show that these clubs are increasing rapidly in numbers and that much interest is being taken in them. Speaking in general concerning them, it may be explained that their plan of operation includes small weekly assesments upon the members, fines for delinquences, and, in some cases, the holding of occasional entertainments, festivals, etc., the proceeds of which are added to the general fund. In this manner, without feeling the expense, the members expect to accumulate a considerable fund by the Summer of 1893, sufficient, perhaps, to defray their expense to the Fair. One of these clubs in South Carolina deposits its money in the principal bank in the town payable only to a committee of six. It is understood that the money will be drawn out on May 1, 1893, and distributed to the members, each receiving an amount proportionate to his or her contributions.

A man in Monmouth, Ill., has hit upon an ingenious device for securing the same end. He has had made, and is putting on the market a "World's Fair Saving Bank." It is of pottery make, and the only way to recover anything that is put into it is to break it. The idea is that the different members of the family will deposit their small change in this bank, as occasion offers, and that in the course of the next two years the contributions will swell to an amount sufficient to take the entire family to the Fair, or, at least, to defray a large part of the expense. These banks are said to be going off like hot cakes.

Electrical Welding of Wheels and Rails

An invention is now undergoing investigation which promises the improvement of railway traffic. The invention consists of a small dynamo and an auxiliary engine placed upon the locomotive in such a way as to be easily operated, furnishing a current of small force but large quantity, which is made to pass from one pole of the dynamo to one pair of driving wheels, thence along the rail to the other pair of driving wheels thence to the other pole of the dynamo, thus forming a traveling circuit, moving at all times with the locomotive. By means of this current an incipient weld is caused between the wheels and rails at the point of contact, preventing the slipping of wheels. The working model of the device shows an increase of 400 per cent. in the hauling power of the locomotive. The model without the application of the current would not mount a grade of fifteen per cent., but when the current was applied, it mounted a grade of thirty-five per cent. A locomotive is now being equipped with the invention to test it on the Baltimore and Ohio Railway.

LAKE SUPERIOR MINING NOTES.

MARQUETTE RANGE.

The ore in the east end of the Champion, a comparatively recent discovery, is proving up magnificently. Enough has already been done to show that all the levels previously opened in that end of the property will again become available from the eastern shaft, and which was practically abandoned because of the lack of ore.—[Florence Mining News.

MENOMINEE RANGE.

Charley Peterson and his associates, who are carrying on extensive exploratory operations on the southwest quarter of the southeast quarter of section 18, 40 18 (this town), are in a very fair way of opening up and developing a valuable mining property. They have a shaft bottomed in an excellent grade of nearly clean ore at a depth of 32 feet, and are down four feet in the metal. Other pits, situated within a distance of 100 feet or more from each other, are also in ore, the deposit lying between red slates and soap rock, which are over 500 feet apart.—[Florence Mining News.

GOGEBIC RANGE.

Although the ore sales for the Gogebic mines have been comparatively light, the outlook is very encouraging for the coming year. During the past few weeks there has been a movement that presages a lively demand during the coming month.—[Ashland Press.

The shaft on section 10, west of the Iron Belt mine, has reached a depth of 120 feet. It will be put down to the 150-foot level and crosscutting north then will be done to test the formation.—[Florence Mining News.

At a depth of 300 feet on the old Emma location (now known as section 6), a crosscut is being run south toward the foot wall to tap the formation. The crosscut is now breasted in banded stuff showing small seams of ore. The indications are that it will be necessary to go deeper before any very large body of ore is reached.—[Florence Mining News.

VERMILION AND MESABA RANGES.

The Stone Iron Co. explorations are carried on on the northwest quarter of the southwest quarter of section 18, 59-14, about three miles from Mesaba station. After sinking several testpits, which were invariably in ore after passing through the rock capping, a ledge of ore was struck near the north line of the 40, from four to six feet below the surface, that shows up remarkably well. A 30-foot pit about 100 feet southeast of this uncovered deposit, at a depth of 12 feet, passed through the ore ledge and is bottomed in the foot wall formations. It showed the vein here to have a tilt of only 10 or 12 degrees south, and encountered the usual difficulty heretofore experienced on the Mesaba range, viz.; that of a flat formation. But there are redeeming features in favor of the Stone and other Mesaba properties that promise to make the range a developed and paying iron district in spite of this difficulty —a theory that has not heretofore been advanced through the press. Capt. Bice called our attention to the fact that near the railroad and a mile and a-half south of the Stone, the surface formations stood at an angle of 70 degrees. He believes that if they can locate that point where the formation makes its break from a tilt of 12 to 70 degrees immediately below this will be found the proper ore vein, having the desired depth and body. This theory appears very reasonable and almost in proof of it, a visit to the Mallman mine, six miles east, showed just such an existing condition. At this mine they had passed through the ore vein, which, however, had a depth of over 45 feet, but which, too, was only slightly tilted. From the bottom of an 82-foot shaft a crosscut has been driven southerly a distance of 94 feet. And before reaching this distance the formation took a sudden tilt, descending, as expressed, "about 13 inches for every two feet in depth," which would make the vein standing at angle of 46 degrees. This is one of the most important disclosures made for the Mesaba range for some time, and is really the first proof that the formation is not altogether flat. As to the quality of the ore, it is most satisfactory. It is the red specular magnetic, and from several assays it was shown to run from 58 to 64 per cent. with from .017 to .020 in phosphorous, low in silica and without a trace of titanium. The latter is a most important fact, the presence of titanium being most detrimental to previous assays of some Mesaba ores.—[Vermilion Iron Journal.

A good discovery of iron ore has been made at the West Mesaba in section 21, 56 24, about 12 miles from Grand Rapids. The find is on property of the Diamond Mining Co. The find was made by Klages, explorer for the company. Klages sank a shaft 70 feet, when his efforts were rewarded by striking what appears to be a large quantity of the best quality of soft hematite ore. As to the quality, experienced miners such as Captains Morcom and Fay, of the North Star Mining Co., gave their unqualified opinion that it is of the very best found on the range.—[Duluth Herald.

Testing the Wire Wound Gun.

The public test of the Brown segmental-tube wire-wound gun, one of the latest inventions in ordnance, took place yesterday at Fort Wadsworth, on Staten Island. The special object of this test was publicly to demonstrate the high pressures to which a gun of this type can be subjected safely, far in excess, as the inventor declares, of what guns of other types can endure.

The test yesterday was of a cylinder 20 inches long, corresponding exactly to a section of a complete 5 inch Brown gun. The segments of which the inner tube of the gun is built up, as a barrel by its staves, are seventy two in number; this inner tube is wound with twenty-nine turns of wire at a tension of fifty tons to the square inch. At each end of the tube thus constructed for experimental purposes was sunk a steel cap and into this was screwed a breech plug. The cylinder was thus entirely closed with the exception of a small vent large enough to admit the electric wire by which the charges of powder were exploded, and the pressures obtained were measured by gauges screwed into the inner face of one of the breech plugs.

The programme yesterday was to explode successive charges of powders within this closed section of a gun, beginning with a charge of two pound and increasing till a charge of five pounds was reached, expected to give a pressure of over fifty tons to the square inch. The first two were successfully attempted, but after the third it was found impossible to unscrew the breech plug, showing that the tremendous power of the gun must have fractured the inner case-lining, and forced or fused the threads of the screw by which the breech plug was screwed on. This was done with a charge of three pounds one ounce, and the pressure that was estimated to result from this was over 60,000 pounds. The inventor, James Hamilton Brown, and Lieutenant G. A. N. Whistler, who had charge of the test, considered that, notwithstanding this mishap, which they say does not affect the principle involved, the value of the gun was fully shown, for such pressures had never before been attained in ordnance.—[New York Tribune, March 29.

The Smoke Problem in Germany.

One of the latest results of the agitation commenced in Europe several years ago to suppress, or at least moderate, the smoke nuisance, is the offer of two prizes by the Society of German Engineers for essays on the subject. An appropriation of 8,000 marks (about $2,000 has been made for the purpose). One of the prizes is offered for the best essay on smoke-preventing devices applied to steam boiler furnaces, the competition closing on Dec. 31, 1892. The other prize is to be awarded to the best essay on similar devices applicable to domestic use, and to industrial uses where steam boilers do not enter The date of closing of this competition is given as Dec. 31, 1894. Each of the essays is to embrace a brief review of what has been done in the past in these lines, and a comprehensive discussion of smoke-preventing devices of the present time entering the subject in detail. Special importance will be attached to careful records of the results of earlier experience, and to reviews of results secured by smoke ordinances in various countries and cities. Successful smoke-preventing appliances are to be illustrated, in as good a manner as possible, by drawings. The prizes have been fixed at 3,000 marks each ($750), but an additional sum, not to exceed 1,000 marks ($250), is to be allowed for the drawings. The competition is open to all, without regard to nationality, though it is but fair to presumed that essays in the German language will receive preference.

Southern Mining Notes.

A bank of good fire-clay has been found at Duffield.—The Washington Zinc Co.'s oxide works, at Lynchburg, have started their first section, and the output is said to be of excellent quality. Additional furnaces are under way, and sulphuric acid works will be built as soon as the entire plans are arranged.—Iron ore, which has been tested and found to make good Bessemer steel, has been discovered near Mendota. Specimens of this ore, and also of a brown iron ore found near by, can be had from P. L. Barker.—The President of the Turkey Gap & McQuail Coal Co. estimates that 2,500,000 tons of coal will be moved this year over the extension of the Norfolk & Western Railroad from the Flat Top region and Clinch Valley.—The Pocahontas Co. shipped in January 186,000 tons, the largest shipment yet made. The February output was 169,000 tons.—A company, with a capital of $1,000,000, has been organized at Millwood, to work a newly discovered tin mine in Ashby's Gap.—Coal deposits of unusual thickness have been found near Farmville, close to the railway. Iron deposits are known to exist within a few miles of this coal.—An oil excitement exists at Stanardsville, in Greene county, where indications show petroleum of very high grade. It is claimed that the crude oil gave as good results as to light and lasting qualities, as did a refined oil bought in the neighborhood.—[Tradesman.

Values of Foreign Coins.

The Director of the Mint has estimated, and the Secretary of the Treasury proclaimed, the values of the foreign coins to be followed in estimating the value of all foreign merchandise imported in the United States on and after April 1, 1891. The value of the following silver coins are changed from the value given them in the circular of January 1, 1891:

Coins.	Values Jan. 1, 1891.	Values April 1, 1891.
Florins of Austria-Hungary	.381	.363
Bolizinio of Bolivia	.771	.735
Peso of Central American States	.771	.735
Shanghai tael of China	1.139	1.085
Haikwan tael of China	1.27	1.209
Peso of Colombia	.771	.735
Sucre of Ecuador	.771	.735
Rupee of India	.366	.349
Dollar (peso) of Mexico	.837	.80
Sol of Peru	.771	.735
Rouble of Russia	.617	.588
Manbub of Tripoli	.695	.663
Bolivar of Venezuela	.154	.147
Yen of Japan	.831	.792

The Tariff is a Tax.

The editorial department of an afternoon newspaper, while sauntering about in its private capacity, was asked a few questions about the tariff. "Oh," remarked the department, with an oracular wafture of the hand, "the tariff is a tax."

"Yes," said the inquirer, greatly subdued by the dread profundity of the answer; "I—I—have sometimes heard it referred to in that way, but I really can not understand it to be so." The editorial department looked its most pitiful pity.

"What bothers me," said the questioner, "is wire nails. When the tariff was put on wire nails they were selling at 8 cents a pound. The tariff placed on them was about 4 cents a pound."

"That made them 12 cents a pound."

"Now, that's what troubles me. Under that tariff wire nails are now selling at 2½ cents a pound. How is the tariff a tax in that case?"—[Indianapolis Journal.

THE WORLD'S CANAL ENTERPRISES.

"T. P. R." writes the Pittsburgh *Dispatch* as follows:

Of the numerous completed and projected ship canals in Europe not one, if we except the Holstein, was undertaken with the pretense of accommodating so great an aggregate of tonnage of freight, as is now annually transported by rail between the several Lake Erie ports and the Pitttsburgh, Shenango and Mahoning furnace district.

Many of them were constructed to benefit commerce merely by shortening the distance, or the sailing time of vessels, or to avoid the dangers existing at some seasons in navigating around certain capes or peninsulas, of which we have types in this country, in the projected Cape Cod, the Delaware & Chesapeake and the Florida Ship Canal.

A few ship canals have been undertaken in Europe for the benefit of single cities—while a number of these are in progress or contemplated. Not one of them, however, possess the advantages claimed for the projected Lake Erie & Ohio River Canal, viz.: A connection of two distinct and previously separated systems of navigation, and the Lake Erie Canal does this, it may be parenthetically added, where two such great systems approach each other at the nearest point, the same point also where the interchange of traffic between them is many times greater than anywhere else along our rivers and lake coast lines.

So overwhelming is the call for a grand water connection in this region that it forces the conviction that where the inducements only half as great as they are—any of the European governments—even those which own and control the railroads—would construct it, if similar conditions existed in their own territories.

In this connection a statement in regard to some of the larger European canals may be interesting: The Languedoc Canal (Canal du Midi), France, extends from Bordeaux, on the Bay of Biscay, to Cette on the Mediterranean Sea; length, 140 miles; summit, 610 feet above the sea; depth, 6 feet 7 inches; 119 locks; cost, $7,200,000. This canal passes boats of about 300 tons capacity, whereas the Lake Erie & Ohio River Canal, as projected, would have a capacity for steamers carrying from 1,500 to 2,000 tons, and for barges of almost unlimited capacity.

The lockage on the Languedoc is 461 feet in excess and the number of its locks almost 24 times as great as those proposed for the Lake Erie & Ohio River Canal, yet notwithstanding the physical drawbacks of excessive lockage and comparatively small size, it does a great business in active competition with railroads. Its present capacity is about that of the Erie Canal, of New York, but it is now proposed to expend $130,000,000 upon an enlargement and lowering its summit by a great cut 163 feet deep, but even then it would still have 135 feet more lockage than the Lake Erie & Ohio Canal. One of the chief arguments for the proposed enlargement is the saving it would afford for sea-going vessels of the 700 miles extra in passing around Spain via Gibraltar.

The Caledonian Canal, crossing the Highlands of Scotland, between Inverness Firth and Lochiel: Length, 60 miles, 38 of which are through a chain of lakes. Summit, 100 feet above sea; 28 locks, 170x40 feet; available depth, 17 feet; cost $5,000,000. On the Lake Erie & Ohio Canal there will be 50 locks size 315x45 feet; total lockage, 759 feet; depth, 15 feet; available for vessels, 14 feet.

North Holland Canal, Zuyder Zee to Amsterdam, 52 miles; double tide locks at each end; 237x51 and 82x18½ feet each; depth, 20 feet, but canal only 50 feet wide on the bottom, just half the bottom width of the Lake Erie & Ohio Canal, as proposed. The Holland Canal was finished in 1825, at a cost of $5,000,000.

Gota Canal, crossing Sweden North Sea to Stockholm: Summit, 300 feet above sea—total lockage 600 feet. Length 300 miles, of which by far the greater part is through a series of small lakes. In all there are 76 locks—or 26 more locks than on the proposed Lake Erie & Ohio Canal (though the total lift is less on the Gota). Depth of canal 10 feet—bottom width 46 feet. Five years ago 10,000 vessels per annum were passed through this canal, as per statement of R. E. Peary, in his paper on ship canals, August, 1889, Trans-American Society of Civil Engineers. On the Lake Erie & Ohio Canal the least navigable period, or season of coldest or longest Winters, will be 214 days, so that 23 vessels each way daily would amount to about 10,000 vessels for the season.

It would be quite modest to assume the average cargo in such a canal at 1,000 tons—our ordinary coal boats on the Ohio carry 1,000 tons of coal—which would make 10,000,000 tons per annum. The ultimate capacity of such a canal, even with single locks, is not less than 25,000 tons. But that such numbers of vessels will pass through 76 locks on the Swedish canal, in order to save sailing around the country, is evidence of the practical utility of the work.

Amsterdam Canal.—Crossing Holland to the North Sea, tide locks 390x60 feet and 227x40 feet, length 15½ miles, bottom width of canal 88½ feet, depth 23 feet. It was mostly dredged work, a great portion of which was removed for four cents per cubic yard, 21,000,000 cubic yards in all excavated. Total cost of work, $15,000,000. Amsterdam was driven to this work by the rivalry of Rotterdam and Antwerp in taking its business, and that the canal proved a great success we may judge from the statement that 700 vessels, large and small, were passed through its large double locks; many vessels were possibly locked together on this holiday occasion. The work was commenced in 1868 and completed in 1876. It is crossed by two railways and one road on swing bridges.

St. Petersburg Canal.—Length, 18 miles; depth, 22 feet; 63,000 cubic yards of material excavated in making this grand approach from Crondstadt to the capital, or 20,000,000 cubic yards more than is required in the excavation of the entire Lake Erie & Ohio Canal between Pittsburgh and Conneaut harbor, a distance of 126 miles. This Russian canal was built between the years 1878 to 1884.

Gheny Ternenzen Canal.—Twenty-one miles long; constructed to save 105 miles distance lost by the river Scheldt from Ghent to the sea. It was a very ancient work, but enlarged in 1827 to its present depth of 20 feet, with bottom width of 56 feet.

There are many canals in Europe besides those here given. In France alone there are more than 60 distinct lines of canals affording a navigable length of 3,000 miles, besides 52 rivers which have been made navigable by means of locks and dams, with an aggregate length of 2,000 miles, upon which the French Government has spent on construction account alone, during the 70 years previous to 1887, up to which date Col. William E. Merrill, United States Engineer, concluded the report, the sum of $265,947,100. The French canals are nearly all free, and that the cost of their maintenance is small in proportion to that of railways may be judged from the fact that during 1887 their cost, exclusive of salaries of officials, on these 5,000 miles of canals and canalized river was only $2,200,000, or $440 per mile.

Nothing can more clearly demonstrate the advantages of water transportation over railways in operating expenses than a statement like this. After a canal is paid for—its maintenance—if it was properly constructed in the first instance—is really insignificant. Not enough attention has been directed to this branch of the subject heretofore, but it is hoped our people will not long delay their investigations. It is a new field to many, no doubt, because of the poverty of experience with ship canals in this country—there being not one in the United States, though Canada with the Welland Canal presents us with an object lesson near enough at hand.

Of the great canals not entirely completed, reference might be made to the Manchester and Corinth canals—both of which are, however, so well known as to require only a mention.

There remains the North Sea and Baltic, or Holstein Canal, however, with which Americans are not generally so familiar. This project dates back 40 years, but it was not until as late as 1887, that the German Empire entered actively upon its construction. There were previously existing three small canals across the isthmus, but it is now being cut down to sea level for 60 miles, at an expense of $39,000,000, in order to save vessels from London to the Baltic 237 miles, and from Western German ports to the same, 425 miles heretofore lost in passing around Denmark, which passage is crooked and dangerous at times for sailing.

Of course, also, the Government indorses it for military reasons, as the largest ironclads will be able to pass through it from one sea to the other. The removal of 67,000,000 cubic yards of material is involved in the construction. Mr. Peary, in the paper referred to, in speaking of this project, says:

"The North Sea-Baltic traffic is variously estimated at from 36,670 to 40,000 vessels annually, with a registered tonnage of 12,240,000 tons, 5,500,000 to 9,000,000 tons which would use the canal at a toll of 18¾ cents per registered ton." This is equivalent to nearly 40 cents per ton of actual cargo, or quite fully double that amount that even a private corporation would probably ask for tolls on the Lake Erie & Ohio River Canal, if built by individual enterprise.

There is here a distinct admission that toll rates, which would be considered excessive in this country, are expected to be paid merely as a bonus on time saved, and in a reduction of insurance charges.

The figures of the interchange of traffic between the North Sea and the Baltic appear great, yet after all they are exceeded by the traffic of our great lakes—more than 40,000 vessels of double the average cargo capacity of those engaged in the North Sea and the Baltic annually pass through the Detroit river, connecting Lakes Huron and Erie; so that the commerce of a few of our Northwestern States vastly exceeds that of all Northern Germany, Russia, Sweden and Denmark with the North Sea and the Atlantic ports.

As Americans we are entitled to "blow," even harder than we are credited with doing, for it is a fact that the vastness of the trade carried upon our "great unsalted seas" is realized by very few of our people. Pittsburgh can be made practically as accessible to Detroit, Chicago and Duluth as Buffalo is to-day. The coal trade of Duluth doubles every three years, and now receives as much coal as Cincinnati, but this is diverging.

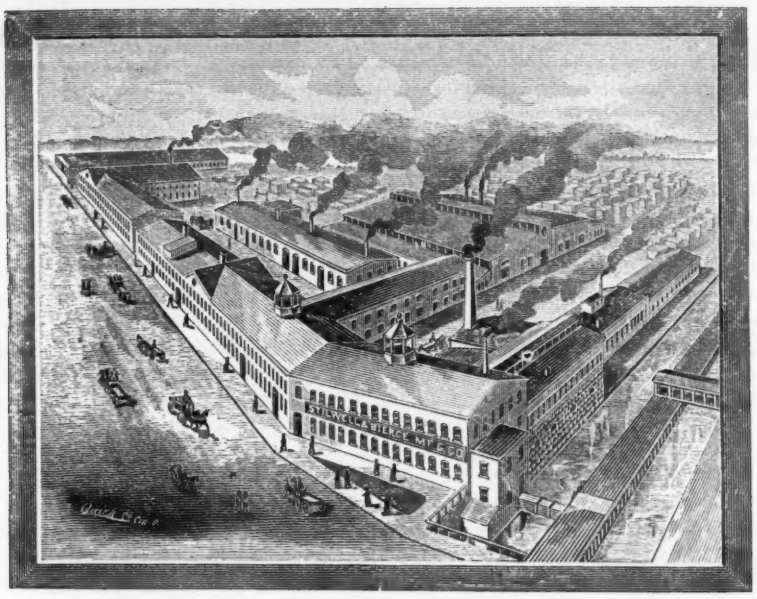
Of projected ship canals in Europe there are the great Birmingham Canal, the Newcastle-on Tyne Canal, Irish Canal (crossing the island), Brussels Canal, Paris-Boulogne Canal, Baltic-Black Sea Canal, Bruges Canal, Black Sea-Caspian Canal, which, however, is in Asia, and several others, to say nothing of those in India and elsewhere. Space forbids any detailed reference to them, however, but that this is the era of great canals all the world over save in our own country there can be no doubt.

Peculiar Phenomena in Welding.

Iron is now plated with nickel by pressure between rolls at a welding heat, the nickel being recovered from the clippings and shearings of the plates by the action of dilute sulphuric acid at a temperature of 55° C.; the iron is dissolved and the nickel is obtained in the form of thin sheets as it was melted upon the iron. The operation is complete when the evolution of hydrogen ceases—even fresh acid at the same temperature has practically no effect. But though the separation of the two metals is apparently perfectly made, a a curious fact is noted, namely, that when the residual nickel is chemically examined it is found to differ from its original composition, the amount of iron present being notably increased. For example, in a nickel containing originally only .09 per cent. of iron, two per cent. more was found when it was recovered from the plate cuttings, and even by a long continued treatment with dilute acid, the iron could not be sensibly reduced. This peculiar behavior, it is believed, points to the possibility of positive chemical combination taking place between the metals, and that alloys of iron and nickel are produced in the process of welding—it being a fact very well known to chemists and metallurgists that iron, with but even a small proportion of nickel, resists the action of acids much more effectively than the pure metal.—[Australian Mining Standard.

WORKS OF THE STILWELL & BIERCE MANUFACTURING COMPANY.

The Stilwell & Bierce Manufacturing Co., whose works are here illustrated, are proprietors of one of the largest machinery establishments in the West. This enterprise dates back to 1866, and was commenced in a very small way by G. N. Bierce and E. R. Stilwell, and this moderate start formed the nucleus from which was developed the enormous business now operated by the Stilwell & Bierce Manufacturing Co., which was incorporated in 1870. Their shops occupy a frontage of nearly 1,000 feet with large rear additions. The mechanical department embraces the heaviest and most modern machinery appliances and tools, most of which is of late introduction, the facilities of the works having recently been nearly doubled in capacity. It is operated by water power with steam power in reserve and a force of about 350 skilled workmen are here given lucrative employment. The establishment is divided



into three general departments, each manned by an accomplished engineer with a suitable force of assistants. These departments cover the manufacture of the celebrated Victor turbine water wheels, both vertical and horizontal, in great variety of styles and sizes, and power connections of all kinds, their catalogue of gears, pulleys, etc., being very complete; and extensive modern flour mill machinery, including Odell's roller mills, reels, purifiers, etc., the good qualities of which are attested by the number of large first-class flour mills built by them; and devices for heating and purifying the feed-water for steam boilers, prominent among which are Stilwell's exhaust heater and filiter combined, of which over 5,000 are in daily use, and Stilwell's live steam purifier, a more recent invention, which is very successful in removing from feed-water sulphates of lime, magnesia and other impurities which are beyond the reach of any heater using exhaust steam. Handsome catalogues fully illustrating and describing their various specialties will be cheerfully furnished to all interested parties who will state their requirements and apply to Stilwell & Bierce Manufacturing Co., Dayton, O.

THE BIRTH OF THE IRON TRADE.

The first mention of iron ore on this continent was by Thomas Harriot, the geographer of the second expedition to Virginia. This expedition founded a colony on Roanoke Island but being menaced by Indians the colonists became discouraged, and returned to England in 1586.

On April 10th, 1608, the colony at Jamestown, Va., made a shipment of iron ore to England, and 17 tons of iron made in England from this ore were sold to the East India Co. at £4 per ton. An attempt was made in the years 1620 to 1622, to erect iron works at Falling Creek, about 66 miles above Jamestown, but on the 10th of March, 1622, the buildings were burned by the Indians and 347 persons were killed.

The first iron works built in this country that can be called successful, were those erected in the Province of Massachusetts Bay, in what is now the town of Saugus, about 10 miles northeast of Boston. These works were commenced late in the year 1643 or early in 1644. The first piece of hollow ware made in America was cast at Lynn in 1645, probably direct from the blast furnace, or possibly from a reverberatory furnace, as the cupola for smelting iron was not invented until 1790.

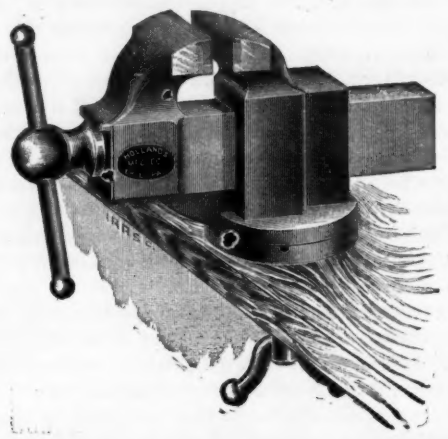
In 1731 there were in New England six furnaces for hollow ware and 19 forges or bloomaries for bar iron. There were then no furnaces for pig iron exclusively, nor any refineries for pig metal; there was one slitting mill and a "manufacture of nails." In that year there were no iron works in New York, but in New Jersey there were one furnace and "several forges." Fifteen furnaces and 30 bloomaries represented the growth of the iron industry during the 86 years following its birth at Lynn.

In 1750 there were four rolling mills or slitting mills in the colonies. In that year an act was passed in England prohibiting their further erection, and this act was zealously enforced. An instance is given, however, of a slitting mill being erected in defiance of the law, at Boonton, N. J., the mill being hidden below a mill for grinding grain. From 1750 to the Revolution, the iron industry was chiefly confined to the manufacture of pig and bar iron in the furnaces, forges and mills already erected and of castings from the blast furnaces. During the Revolution one of the most notable events connected with the manufacture of iron was the making of the great iron chain which in 1778 was stretched across the Hudson river at West Point, to prevent the passage of the British vessels. It was made at the Sterling Iron Works, about 25 miles back of West Point. The total weight of the chain was 180 tons.

The first rolling mill erected in the United States to "puddle" iron and roll it into bars was built at Plumsock, Fayette County, Pa., in 1816 and 1817, the puddling process having been invented by Henry Coot, in England, in 1784. In the early practice in this country, the operation of puddling was preceded by the operation of refining, carried on in an apparatus known as a refinery. The puddling of the refined iron was done on a "sand bottom," the decarbonizing being performed by the heated air passing over the metal.

MACHINISTS' VISES.

The accompanying cut illustrates one of the many machinists' vises that are manufactured by Holland's Manufacturing Co, of Erie, Pa. We wish to call attention to the superior quality and workmanship their vises have attained. The castings are made from a mixture specially adapted for this class of work; crucible steel jaws firmly welded and tempered, patterns scientifically proportioned for extra strength and durability, as well as convenience in use, and has no complicated mechanism to be constantly getting out of



repair. All their swivel base vises are equipped with Hough's improved self-adjusting swivel base, which, for simplicity and strength, has no equal.

The Holland's Manufacturing Co. make everything in the line of machinists' tools, and they have obtained a name that would be an honor to any firm. Mr. E. S. Rockefeller is Secretary of this company and solicits correspondence. Any firm desiring anything in the line of plumbers' or machinists' vises, pipe tongs, wheel pipe cutters, wrenches, drills, solid gas pipe, dies, anvils or anything in the line of mechanics' tools will find it to their advantage to address the above firm.

Iron in Texas and Indian Territory.

Unless it shall turn out that the Inspector of Mineral Lands of Texas is an enthusiast who has painted the resources of that State with the color of the rose, there is a big future for that part of Uncle Sam's domain. His geological report, just issued, covers investigations made in the iron fields of northeast Texas, and Indian Territory coke and manganese deposits, and summarizes their relationship to the future iron and steel development of the areas surveyed. The inspector says:

Since my preliminary report to you, two years ago, on the iron ores of eastern Texas, as well as the coal fields of the Indian Nation, and after carefully testing the coal for coking purposes, opening the accessible manganese deposits, as well as investigating the cost of making Bessemer pig iron in Chicago or Pittsburgh, in comparison with your plant in Jefferson, I have no hesitation in stating, without fear of contradiction from any one who will carefully study all of its conditions, that you can produce Bessemer pig iron, in Jefferson, at your plant, for $4 per ton less than can be done either in Chicago or Pittsburgh. Cost of making one ton Bessemer pig iron, in Chicago, this date:

1 ton specular Bessemer ore delivered at furnace, Chicago	$ 5.50
1 ton best Bessemer hematite	4.50
1½ tons Bessemer coke	5.00
Limestone	.30
Labor and repairs, with interest on plant	1.50
Total	$16.80

Cost of making one ton of Bessemer pig iron in Jefferson, Tex.:

1 ton Bessemer Llano or Indian Territory magnetite	$ 3.50
1 ton eastern Texas, Marion and Cass county ores	1.50
1 ton Indian Territory coke	4.00
Limestone	.40
Labor and repairs, with interest on plant	1 50
Total	$10.90

He asserts also that comparative analyses of the ores, coke and coal of Texas and the Indian Territory, are unanimous in demonstrating the quality and value of the Texas ores, which, by careful preparation, have the promise of being equal to the best American product. However, the Texas man should deduct $3 37 from the ore charge he makes against Chicago, inasmuch as Superior ores are 75 per cent. metal, and about $1 off the coke.—[National Labor Tribune.

IT has been affirmed that 1,100 years and more before Christ, some ingenious Chinaman invented the mariner's compass. A writer in the *China Review*, who has been investigating the subject, now asserts that the first unmistakable mention of the compass in the Chinese records is not earlier than the twelfth century of our era, and the instrument undoubtedly became known in Europe before the return from China of Marco Polo, who is fabled to have brought it in his baggage.

THE IRON TRADE OUTLOOK.

The condition of business among the various iron and steel mills at present is comparatively quiet, and no pronounced activity is likely to set in for some few months. The consumption of finished iron at present is very small, considering the enormous consumptive capacity of the country, and large buyers of all kinds of finished materials intend to retrench purchases owing to the unsettled condition of the money and stock markets both at home and abroad. The opinion seems general that the first six months of 1891 will witness a decreased amount of business transactions at values scraping a very low level.

It is an open secret that several prominent firms engaged in the iron and steel business in this neighborhood were rudely shaken up financially during the past Winter owing to the suddenness with which they were confronted with an extremely tight money market, and the consequent reluctance of moneyed institutions to advance loans even on gilt-edged collateral. The abnormal depression in the stock markets, in which the values of railroad shares declined in many cases 25 and 30 per cent., compelled the railroad companies to greatly decrease the amount of their contemplated purchases and practice economy so as to declare the regular dividends. An evidence of the truth of this is the fact that the Edgar Thompson mill has not as yet resumed operations owing to lack of orders. The result of this combined pressure upon the important industry of this locality has been to check its volume to no inconsiderable extent, but the acknowledged supremacy of this beehive gives us unequaled powers of recuperation, which it is hoped will greatly shorten the time of the convalescence of the iron and steel trades.

There have been several strong attempts made by the operators to break the coke strike, and while some few small independent operators are running their works with non union men, the efforts of the operators so far cannot be said to have met with encouraging success. The most important change in the status of affairs occurred on Wednesday, the 25th inst., when the McClure Coke Co. caused considerable excitement throughout the region as a result of their proposition to the men that the latter return to work at a reduction of seven per cent, with the assurance that the price of mining will not fall below $1 per 100 bushels. In the event that the price of coke advances to $2.15 the company agrees to pay the scale of wages ruling last year. The H. C. Frick Co. also posted a sliding scale, similar to that proposed by the McClure Co.

The general shutdown of the blast furnace in the Mahoning and Shenango valleys also remains unchanged from the condition it assumed when the shut in movement was inaugurated, January 1. Extensive improvements and enlargements have been made to all furnaces in those districts, and they are now in excellent shape for a renewal of operations, but no resumption of work is looked for until at least the settlement of the coke strike. The number of men idle is estimated at 2,000, and general business throughout both valleys is greatly depressed as a result.

Recently, further interruptions have arisen as a result of a temporary suspension in the supply of natural gas, and the Solar Iron Works, of William Clark's Son & Co., has resolved to return to the use of coal in their puddling furnaces. This department is supplied with coal and steam, making now in all six mills wherein the superheated steam and slack process is being used. At Spang, Chalfant & Co.'s their steel mill has just been changed to use coal. The limited supply of gas from the company's private wells is scarcely sufficient to supply their Etna mill.—[Pittsburgh Dispatch.

An Electrical Wedding.

At a wedding, in Baltimore, a few days ago, no sooner had the company been comfortably seated than the room burst into a flood of light from numerous varicolored incandescent electric lamps hidden among the decorations. The entrance of the bride and bridegroom was welcomed by the automatic ringing of electric bells and the playing of electrical musical instruments. After the first course, the room was plunged into semi-darkness, when suddenly, from the floral decorations upon the table, there glowed tiny electric lamps. Not only the flowers, but the interior of the translucent vases in which some of them were gathered, scintillated with flashes of light. After a while a miniature electric lamp, which in some unexplained manner had attached itself to the bride's hair, was seen to glow with dazzling brightness. A toast having been given, two serpents slowly uncoiled themselves and issued from the wine bottle that stood beside the bridal couple. Cigars and coffee were served, and the cigars were lighted by an electric lighter, while the coffee was prepared in full view of the company by an electrical heater. The speeches that were made were liberally applauded by an electrical kettle-drum placed under the table. As the company dispersed, the electric current set off a novel pyrotechnic display, amid the crimson glare of which the festivities ended.

The German Field for Fuel Gas.

From statements in the *Kolnische Zeitung*, upon the annual consumption of coal in the larger of the iron works of Germany, it appears that the Krupp Works uses 820,000 tons, the Bochum Union 800,000 tons, the Dortmund Union 560,000 tons, and the Gutehoffnung Works 743,876 tons, whilst it produces from its pits a total of 864,986 tons. Thus the consumption by these four large works is nearly 3,000,000 tons per annum out of a total of 34,000,000 tons raised. The Horde and the Phœnix Works, the Acieries du Rhin, and four of the other principal iron works in the basin consume 4,000,000 tons, while other German works use nearly another 3,000,000 tons. The total annual consumption of coal by the iron and steel trades, and general engineering works, amounts to about 30 per cent. of the quantity mined per annum.

Electrical Transmission of Power.

In the recent competition instituted by the Cataract Construction Co., for the utilization of the power of Niagara Falls, there were 15 different schemes presented, of which seven proposed electrical transmission of power, two hydraulic, and six pneumatic. Of the electrical schemes two advocated alternate-current transmission at 5 000 and 10,000 volts, and the remaining five continuous-current transmission of potentials varying from 1,600 to 4 500 volts. The fact that the number of electrical schemes proposed was less than the sum of the pneumatic and hydraulic plans, said Mr. Gisbert Kapp, in a recent lecture before the Society of Arts, London, showed that electrical engineers were scarcely prepared to deal with a problem of this magnitude. At present the limits of distance for the electric transmission of power at a reasonable cost are about four to five miles. Beyond the latter distance the economical voltage for 500 hors-epower is beyond the capacity of one machine. Practically, the extreme limit for direct current is between 2,000 and 3,000 volts.

THE DETERMINATION OF PHOSPHOROUS IN STEEL.

Two new methods for the determination of phosphorus in steel are described in *Stahl und Eisen*. The first is an improvement over a former method devised by Dr. M. A von Reiss. In this the amount of phosphorus is determined by measuring the volume of the yellow precipitate from a molybdate solution. 3 5 grammes of steel are dissolved in 50 cubic centimeters nitric acid, 1 23 specific gravity, and oxidized with permanganate, potassium oxalate being finally added: 80 cubic centimeters ammonium nitrate solution (160 grammes to one litre) are added, and the whole is heated to boiling. The temperature is then allowed to fall to 95° C., and the phosphorus is precipitated with 50 cubic centimeters molybdate solution. The temperature, after addition of the molybdate, is about 75°, and the yellow precipitate separates and settles quickly. The volume of the precipitate is not, however, in direct proportion to the percentage of phosphorus, as with increase in the percentage of phosphorus the volume increases at a slower rate; that is, the factor decreases regularly with increase of phosphorus. The volumes of the precipitate and corresponding percentages are given in a table.

The second method, proposed by Prof. Rud. Namias is colorimetric, and has its basis in the intensely blue color which results when phosphomolybdate of ammonium is dissolved in a solution of sodium hyposulphate. A steel having a phosphorus content of 0 5 per cent. is taken as a standard, and the phosphorus in it is actually determined by a gravimetric method. The details of the method are as follows: A sample of 1 gramme is dissolved in a small beaker in 10 cubic centimetres nitric acid of 24° B. After complete solution, 1 cubic centimetre hydrochloride acid is added, and the solution evaporated to dryness. The residue is dissolved by heating with 3 cubic centimetres HCL and 7 cubic centimetres HNO_3 of 24° B., and 50 cubic centimetres molybdate solution is added. Preliminary heating of the molybdate solution is recommended. This is stirred vigorously and set aside for 1½ hour at a temperature of 50°. The precipitate, including silica and graphite, is then filtered off, and is thoroughly washed with a warm 5 per cent. solution of ammonium chloride, The filter, with precipitate, is placed in a small beaker, and 50 cubic centimetres of a solution of 12 grammes of sodium hyposulphite in one litre of water are added. The residues are heated, with occasional stirring, for ½ hour, to near 100° C. in a water bath. The resulting blue solution is filtered into a 50 cubic centimetre flask, the filter being washed with cold water until the filtrate reaches the mark.

A Great Feat of Rolling.

Metal workers everywhere will be interested in a "great feat" which, says the *American Manufacturer*, has lately been accomplished at the Superior Mill, Allegheny, Pa. The "feat" of rolling a strip of steel for a spring 6 in. wide, ¼-in. thick, and 310 ft. long. This work was successfully performed, and the spring properly tempered at the first effort. That establishment has since received a large order for such springs, which are designed to enter into the construction of a new car motor, for which a great demand is anticipated. Our contemporary takes care to add that the order had previously been tendered to all the large English and Continental works of Europe, none of which would undertake to do it, which in plain Saxon reads that the Yankees have beaten the Europeans in one particular department of industry in which the latter, *e. g.*, the English, have hitherto considered themselves adepts.—[Glasgow Engineer.

The English Iron Market.

Concerning the English markets, our Birmingham correspondents, S. W. Royce & Co., write under date of March 28:

"The state of affairs in the pig iron trade is exceedingly gloomy. At the end of last month prices were steady and a hopeful feeling prevailed, but this was soon changed, rumors of financial trouble in England causing a collapse in prices, and quotations are now about 3s. 6d. to 4s. per ton lower than at the beginning of the month. Little business is now being done, and for prompt delivery only; makers will not sell forward, and it is expected that more furnaces will be blown out. The shipments from Middleborough up to the 24th inst., are returned as 52,418 tons, as against 60,094 in last month up to the same date."

Homes in the West.

Special through train, April 21st. Across the continent without change of cars! Special cheap rate excursion via the Nickel Plate. Through tourist sleeping cars at nominal expense. Free seats in comfortable reclining chairs to through passengers. Facilities for preparing hot tea and coffee are afforded, and a journey to the Pacific Coast, embracing all the essential features of the "luxuries of modern travel on American railroads," may be enjoyed by passengers holding through tickets, which will be on sale at all ticket offices of the Nickel Plate at lowest rates. Baggage checked to destination. For further information inquire of any agent of the Nickel Plate or B. F. Horner, G. P. A., Cleveland, O.

ALUMINUM AND STEEL.

In the inaugural lecture under the auspices of the newly-formed Metallurgical Society, in connection with the Sheffield (Eng.) Technical School, given by Prof. Arnold, the subject being "The application of aluminum to the manufacture of steel and steel castings," the speaker said that the recent literature that had been placed before them respecting the effects of aluminum on steel had been so widely discrepant that he decided, for that lecture, to make experiments of his own and lay them before the public. His researches had been made on different lines to those adopted by Mr. Hadfield, for he thought it would be superfluous to again go over the ground so fully covered by that gentleman. The Professor then, by the aid of numerous illustrations thrown on the screen with a powerful lantern, proceeded to explain the various effects of aluminum on steel, both mild and hard, as compared with the melting and usage of steel where aluminum had not been used. He first dwelt upon crucible cast steel, secondly explained blowholes, and lastly gave illustrations of steel castings, with and without aluminum. He explained the causes, effect, and cure of blow-holes and piping. The professor not only attempted to prove that steel made with the use of aluminum was better than that made without, but also that there was a great saving from a monetary point of view. In reference to blow-holes, he gave illustrations of experiments made by himself, showing that a proper use of aluminum prevents blow-holes, though he admitted that the amount of aluminum to be used was a matter for careful study by those experimenting. In dealing with "pulling," he said that castings would often appear perfectly clear, without flaw, whereas there were serious imperfections invisible to the naked eye. How far this would effect large forgings he could not say, but he discovered it in his experiments. Concluding, Professor Arnold said the metallurgist of the future would have to be a different man from that of the past. Before he could be said to be a thorough master of his profession he must have a knowledge of the chemistry of mechanical physics and of objects, and he thought the mere acquirement of this knowledge would have a refining influence on the person studying. He knew in saying that he was going against what was said at the Firth College the other evening by Professor Anderson, the professor of classics. Everybody appreciated the importance of Professor Anderson's work, and nobody more than he did, but he thought that Professor Anderson might extend the same spirit to them that they extended to him. In his exposition on art proper the other evening Professor Anderson deprecated technical education, and spoke of it as a tendency to develop the baser mechanical arts. He would say that the baser mechanical arts had made Great Britain what she was, and if she was to maintain her position she could only do so by a vigorous development of these baser mechanical arts. In the future, as in the past, they would have to look to these baser mechanical arts to feed and clothe the toiling millions of that vast industrial empire.

Southern Railroads and Southern Iron Makers.

In a letter, read at the recent basic steel banquet at Chattanooga, Mr. A. S. Hewitt made the following pertinent remarks:

I am afraid that the Southern people do not appreciate how much they owe to the managers of the great railway system of the South for the remarkable progress which has been made in the development of the coal and iron resources of the Southern country. I know of nothing in the history of industry more remarkable than the intelligence with which the railway managers have recognized the necessity for low freights on raw materials, and if to-day the South has demonstrated its ability to hold its own in the markets of the North for its products, this result is due entirely to the liberal views which Mr. Inman and other gentlemen associated with him and in other railway systems have adopted in dealing with the great problem of transportation. Instead of striving to embarrass the plans and restrict the powers of these benefactors of the South the Southern States ought to give them *carte blanche* to carry out their plans on the broadest possible scale, and free from injurious conditions which only impede the work of production, and increase the commodities to the consumer. To-day the South has the cheapest transportation in the world, and hence it is emphatically the most prosperous region in the world. This state of affairs, however, will not last long if the Legislatures of the Southern States shall attempt to impose obnoxious conditions upon the investment of capital, which must necessarily come from the outside. The great want of the world is capital. It is the only source from which labor can derive the means of support when it is engaged in the work of production. The attacks which have been made in various directions upon the security which capital requires for its protection will only surround the borrower with more unfavorable conditions than those of which he now complains. Good faith is the foundation of progress. If the South shall sternly set its face against all repudiation, against all violation of plighted faith, its future is assured and its people will be the happiest and the most contented in the world.

THE official trial of a telephone line between London and Paris took place recently. In an upper room of the post office telegraph buildings in St. Martin's-le-Grand, instruments and wires connecting the two capitals are affixed to a long board, to which seven different forms of telephonic transmitters are attached, among the types being the Gower-Bell, Western Electric, De Jongh, Berliner, and Hunnings. The instrument which is favored by the English post office, however, is a modified form of the Gower-Bell with double poles and bell receiver. This was the instrument used, and with most satisfactory results. When the service is open to the public, three minutes will be allowed to each speaker, and no one will be granted more than six minutes' uninterrupted use of the machine. There cannot be any disputes about the exactness of the time, because a small instrument beats seconds in accord with the chronometer clock, and when it has accomplished 180 beats, closes the means of conversation.

INDUSTRIAL SUMMARY.

New Enterprises:—

W. C. Codd, of Baltimore, Md., is negotiating for the establishment of boiler works in Roanoke, Va.

It is reported that a company with $60,000 capital will be manufacturing wire nails, at New Philadelphia, O., by July 1.

Several hundred men will be employed by the Damascus Steel Co, of Portsmouth, O., in its new works in Denver, Col., which will cost in the neighborhood of $250,000.

Anthony Humphrey and J. H. Hanscom, of the Hyde Iron Works foundry department, have purchased the old barytes mill property, at Bath, Me., and will convert it into another iron foundry.

At Newport, Ky., L. H. Wilson, J. M. Raney, W. W. Worcester and others have incorporated the Worcester Wire Manufacturing Co., for the purpose of manufacturing wire goods; capital stock, $12,000.

The Hartford Engine & Machine Works is the style of a new concern, at Hartford, Conn. Small steam engines, pumps and other machinery of the kind will be built, including special machines and tools.

Wash. Rooch, of Atlanta, Ga.; W. J. Pollard, of Augusta, Ga.; D. E. Marable and others have incorporated the Patent & Specialty Manufacturing Co., to deal in and manufacture patents, etc.; capital stock $20,000, with privilege of increasing to $50,000.

The Wheeler & Tappan Co. has been incorporated, at Chicago, to manufacture and deal in steam pumps, machinery and appliances. The concern has a capital stock of $15,000, and its incorporators are: Thomas J. Wheeler, Amos K. Tannan and F. J. Griffen.

A party of capitalists representing the National Safe Deposit & Vault Manufacturing Co., of Pittsburgh, and representatives of the Chicago Safe & Lock Co. are said to have interviewed Youngstown capitalists, proposing to build a large safe factory at that place. They desire to capitalize the new concern at $350,000.

Wm. J. Lewis, Henry Lloyd, Cephas Taylor, Wm. J. Lewis, Jr., and Edgar K. Stephenson, of Pittsburgh, Pa, will make application for a charter for the Linden Steel Co. This action will simply change the firm from a partnership to a corporation. There will be no change that will affect ownership of the mill in any way.

The Southern Manufacturing Co. has been organized at Ft Payne, Ala., with a capital stock of $25,000, to manufacture wire screens and doors, making a specialty of the new Porter adjustable window screen. A building has been purchased to be used for a factory, and manufacturing will commence in ten days. V. W. Rand will be President, and C. M. Ide, Secretary.

A charter has beeen granted to the Standard Manufacturing Co., to manufacture bicycles and do a general manufacturing business, at Martinsburg, W. Va. Capital stock, $5,000, with the privilege of increasing it to $50,000. The incorporators are: Peyton R. Harrison, of Rockford, Ill; R. G. Surbridge, of Chicago, and J. W. McCherry, M. A. Snodgrass and Charles D. Mattheis, Martinsburg. Mr. Surbridge is the patentee of the bicycle to be manufactured.

The New Castle Iron Mining Co. is the name of a new corporation that will have its headquarters in Duluth, Minn. It will begin operations with a capital of $250,000, limiting its indebtedness to $25,000. The projectors of the enterprise are: Frank I. Tedford, Frank Hibbing, T. H. Presnell, A. E. Humphreys and James A. Boggs. All the incorporators are placed on the first board of directors, and the officials are: A. E. Humphreys, President; T. H. Presnell, Vice-President; James A. Boggs, Secretary, and Frank I. Tedford, Treasurer. Among other branches of business in which the company is empowered to engage are dealing in and working mining property, and reducing and manufacturing iron, steel, copper, tin and other metals.

Additions, Enlargements, Removals, etc.:—

J. C. Shaw, of Collins, O., will remove his pump works to Clarksville, Tenn.

The Lead Hill Foundry & Machine Shops, at Lead Hill, Ark., expect to put in new machinery.

The Paige Tube Co., of Warren, O., will erect a foundry 50x75, for the purpose of doing their own casting.

Scott Machine & Hardware Co., at Denver, Col., are enlarging premises to double former size, and will put in several new tools.

The Case Engine Co., of New Britain, Conn., are building an addition, 35x50 feet, to their shops, and will soon have it equipped and ready for occupancy.

Pratt & Cady, of Hartford, Conn., have erected a new brick foundry, 75x240, with monitor roof, and having a capacity of over 40 tons per day. It is wholly of iron, and a pattern room, casting room, and storage sheds have also been built, nearly of equal size.

The Pueblo Iron Foundry Co., F. P. Lehner, proprietor, at Pueblo, Col., are now erecting a fine machine shop, 44x160. This will be equipped with modern tools. The foundry department will be still further improved, and present capacity for melting iron be doubled. When completed, 16 to 20 tons can be melted per day.

The Cooper Boiler & Engine Co., of St. Johns, Mich., employing about 50 hands in the manufacture of boilers and engines, has decided to move its plant to Muncie, Ind. The company has been manufacturing only small boilers and engines, but it is the intention on moving the plant to Muncie to increase the facilities and manufacture all sizes up to as large as 50 horse-power. A general machine shop will be added to the business.

D. K. Norton & Son have removed from the corner of Second and Elm streets Cincinnati, O., to the corner of Front and Elm streets. In this new location they have a building 82 feet long on Elm street and 50 feet wide on Front street and three stories high. They have put in a 50 horse-power engine and boiler, a platform elevator, which will raise 5,000 pounds, and an independent hand hoist. In their new location with more room and other

PROTECTING YOUR BUILDINGS With an automatic fire sprinkler system makes it absolutely fire proof. All Insurance Companies recognize the "Neracher" as the best made and will make liberal reductions on your present rates if you equip. In this way the system pays for itself inside of two years' time.

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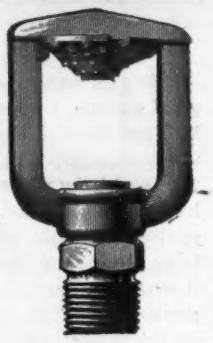

THE NERACHER SPRINKLER CO., - WARREN, O.

BRANCH OFFICES:

Boston, Chicago, St. Louis, Cleveland, Cincinnati, Minneapolis, Pittsburgh.

conveniences they will be better prepared than ever to meet the needs of their already large and increasing business. This firm furnished a 50-horse-power horizontal engine and connecting machinery for the new factory of the Overman Carriage Co., corner of Wade, Denman and Faulkner streets, Cincinnati, O., and have a letter from this firm saying that the engine was started up on January 14, and everything satisfactory and in perfect working order.

The Chandler & Taylor Co., of Indianapolis, Ind., has recently put up a large boiler shop for the manufacture of stationary and portable boilers for use in connection with its large and growing engine trade. This addition to the company's plant is provided with the most modern of tools for the manufacture of standard, stationary and fire-box boilers, and has every facility for both handling and manufacturing. The superior qualities of the product of the machine department of this company has been recognized in the past by those conversant with the subject, and, in embarking in the new field of boiler making, every assurance is given that the high standard which has been maintained in the engine will also be embodied in the boiler. The continued increase of its business has made it necessary to erect, in addition to the boiler shop, a three-story brick warehouse for the storing of the manufactured product, in order to give increased room for machine tools. The rapid development of the business of the company has made these additions necessary, and it reports that the outlook is particularly bright for the coming season, and preparations are now being made for taking care of a larger trade this year than any in the history of the establishment.

General Industrial Notes:—

The National Tube Works of McKeesport, Pa., has just completed an order for 24-inch pipe for a city in South America, to be used as water pipe.

The business of James Hunter & Son, machinists, at North Adams, Mass., has been formed into a corporation, styled the James Hunter Machine Co., with a capital of $50,000. One hundred and twenty-five hands are employed.

We are in receipt of the 1891 catalogue of the Indiana Machine Works, of Fort Wayne, Ind. This firm is one of the largest and best known manufacturers of wood-working machinery in the country. They can equip a wood-working plant complete from the engine to emery wheels, and their catalogue gives a full list of different goods which they manufacture and handle. People in need of their line of goods should correspond with them.

The Garry Iron & Steel Roofing Co., located at 152-168 Merwin St., Cleveland, report a very fine trade for this season of the year and that they have a large number of orders ahead, some of which are for May and June deliveries. They are exporting their goods very largely to Mexico, South America and other foreign ports, and recently received an order from St. Petersburgh, Russia, for their celebrated Continental Metallic Shingle, also from South America for a large quantity of their corrugated galvanized iron.

How Iron Breaks.

Hundreds of existing railway bridges which carry 20 trains a day with perfect safety would break down quickly under 20 trains per hour, writes a British civil engineer. This fact was forced on my attention nearly 20 years ago by the fracture of a number of iron girders of ordinary strength under the five-minute train service. Similarly, when in New York last year, I noticed, in the case of some hundred girders on the elevated railway, that the alternate thrust and pull on the central diagonals from trains passing every two or three minutes had developed a weakness which necessitated the bars being replaced by stronger ones after very short service. Somewhat the same thing had to be done recently with a bridge over the river Trent, but the train service being small the life of the bars was measured by years instead of months. If ships were always among great waves the number going to the bottom would be largely increased.

It appears natural enough to every one that a piece even of the toughest wire should be quickly broken if bent backward and forward to a sharp angle; but, perhaps, only to locomotive and marine engineers does it appear equally natural that the same result would follow in time if the bending were so small as to be quite imperceptible to the eye. A locomotive crank axle bends but 1-84 of an inch, and a straight driving-axle a still smaller amount, under the heaviest bending stresses to which they are subject, and yet their life is limited. During the year 1883 one iron axle in 50 broke in running, and one in 15 was renewed in consequence of defects. Taking iron and steel axles together, the number then in use on the railways of the United Kingdom was 14,848, and of these 911 required renewal during the year. Similarly, during the past three years, no less than 228 ocean steamers were disabled by broken shafts, the average safe life of which is said to be about three or four years. Experience has proved that a very moderate stress, alternating from tension to compression, if repeated about 100,000,000 times, will cause a fracture as surely as a bending to an angle repeated only ten miles.—[National Car and Locomotive Builder.

Through Sleepers and Chair-cars.

On April 21st, the Nickel plate will run through cars to the Pacific Coast, with no extra charge for seats in chair-cars, to accommodate the many desiring to go to points in Minnesota, Iowa, Missouri, Kansas, Nebraska, The Dakotas, New Mexico, Colorado, Wyoming, Montana, Utah, Idaho, Nevada, California, Oregon and Washington. For information call on or address any agent of the Nickel Plate or B. F. Horner, G. P. A., Cleveland, O.

Excursion via Valley Railway to Steubenville, O., April 27 and 28, 1891. State Encampment G. A. R. of Ohio.

The Valley Railway will sell excursion tickets on the above dates, good returning until May 1st, inclusive, at the following low rates: Cleveland, $2 30; Akron, $2 10; E. Akron, $2.10; Canton, $1 55 For further information apply to agents or address J. B. Caden, G. A. R., or J. T. Johnson, Gen'l Supt., Cleveland, O.

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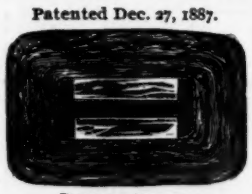

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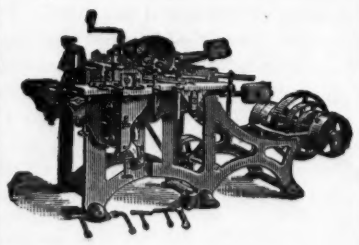

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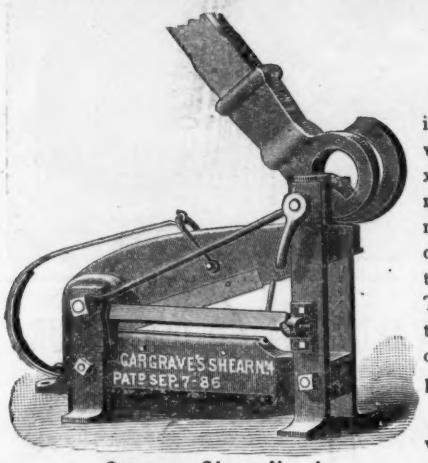
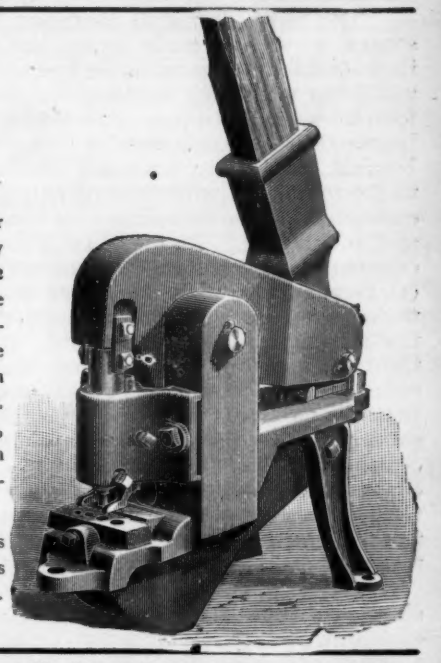


Gargrave Shear No. 4.

The left-hand cut represents Gargrave's Patent Shears, a machine for cutting bar iron and steel. It is very compact, and by its peculiar construction will do as heavy work as many Shears three or four times its size. It occupies a floor space of but 12 x24 inches. It has a device for holding the bar while being cut, thus enabling one man to operate it. This device can be adjusted instantly to hold a bar of any thickness level and square with the machine. The knives are in plain sight, so that the operator can cut to a pencil mark exactly. Steel and wrought iron are used largely in the manufacture of these Shears, and each one is supplied with a good hickory lever. The parts are interchangeable, and should any repairs be needed at any future time, they can be furnished and will fit. One man can do the work, at one pulling down of the lever. It is not necessary to hitch the iron forward two or three times to complete the work, as is the case with many shears. They are made in four sizes.

The cut to the right represents Gargrave's Improved Punching Machine. It is very compact, and occupies a space of 10 x 20 inches. No expense is spared in its manufacture, and it is a first-class machine in every particular. It is made in two sizes.



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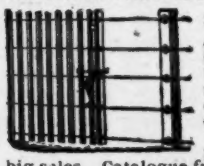

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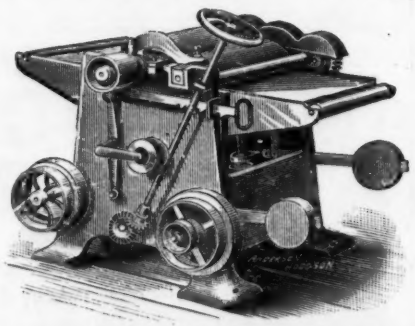

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For further information as to freight rates and sources of supply of raw material, maps, pamphlets, etc., apply to A. POPE, General Freight Agent, or to

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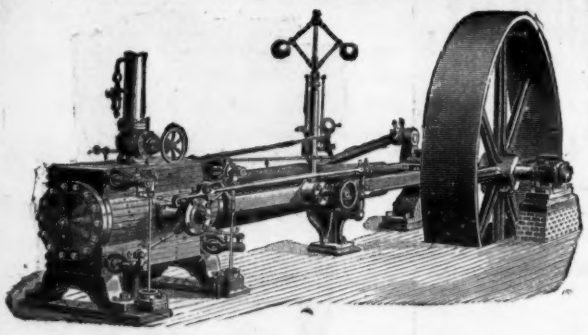

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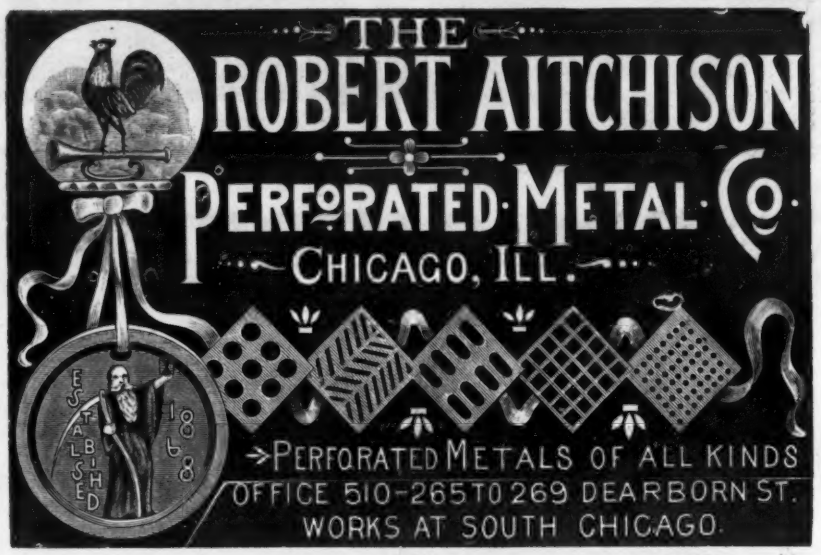

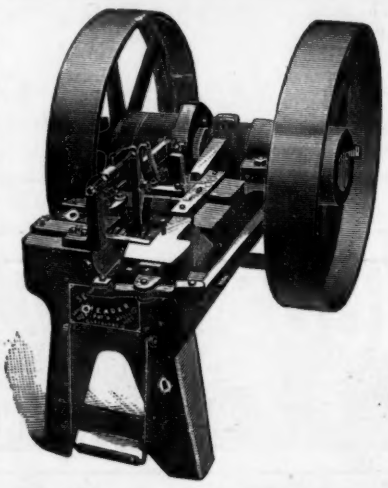

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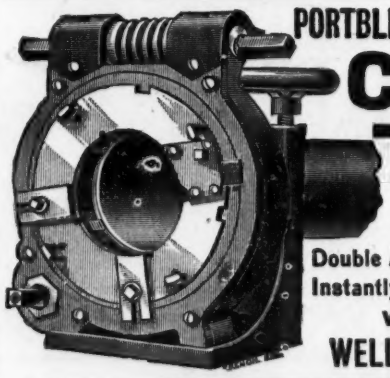

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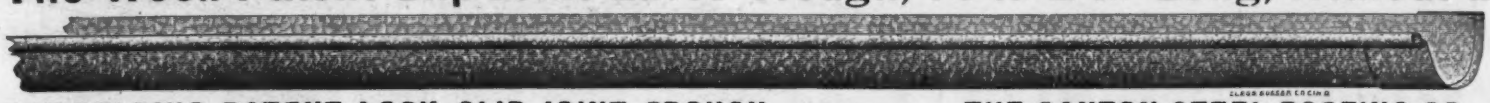

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CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1. foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 75@16 50; Southern Coke No. 3 Foundry, $15 25@16 00; Southern Coke No 1, Softeners, $15 75@16 50; Southern Coke No. 2, Softeners, $14 75@15 50; Ohio Silveries No. 1, $18 00@18 75; Ohio Silveries No. 2, $17 00@ 17 75; Ohio Strong Softeners No. 1, $18 25@19 50; Ohio Strong Softeners No. 2, $17 50@18 75; Lake Superior Charcoal Nos. 1 to 6, $18 00@19 00; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 50@18 50; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 00@15 25; Hanging Rock Coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $16 50@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00@22 00. MILL IRONS—Standard Southern Coke, grey forge, $13 25@13 75; Standard Southern Coke, mottled, $13 00@13 25; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $20 00@20 50; Tennessee Car Wheel, $18 50@19 50; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $17 25@00 00; Mahoning and Shenango Valley strong, No. 2 Foundry, $16 25@00 00; Ohio Softener No. 1, $17 25@00 00; Ohio Softener No. 2, $16 25@ 00 00; Jackson Co. Silveries, $18 00@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $19 00@00 00; Southern Softener No. 1, $16 75@00 00; Southern Softener No. 2, $16 00@00 00; Southern Strong No. 1 Foundry, $17 25@00 00; Southern Strong No. 2 Foundry, $16 50@00 00; Alabama Car Wheel, $22 00@22 50; Hanging Rock Charcoal, $23 00@24 00

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 75@14 00; Southern coke No. 3, $13 25@13 50; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 50@17 00; Southern charcoal, No. 2, $16 00@16 50; Missouri charcoal, No. 1, $17 50@18 00; Missouri charcoal, No. 2, $17 00@17 50. FORGE—Neutral coke, $12 50@13 00; Cold short, $12 50@13 00; Mottled, $12 00@12 25. CAR WHEEL AND MALLEABLE—Southern (standard brands), $21 00@22 00; Southern (other brands), $17 50@18 00; Lake Superior, $21 50@22 50.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $16 00@16 25; Southern Coke No. 2, $15 00@15 25; Southern Coke No. 3, $14 25@14 75; Southern Grey Forge, $14 00@14 25; Southern Charcoal No. 1, $17 75@18 00; Southern Charcoal No. 2, $17 25@17 50; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 50. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 00@20 50; Southern, $19 00@21 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $0 00.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $18 50@19 00; Lake Superior (coke) Bessemer, $18 00@18 50; Katahdin (Maine charcoal), $23 00@24 00; Lake Superior Coke, Foundry, all ore, $18 00@18 50; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $16 25@16 75; Southern Gray Forge, $14 75@15 25; Jackson County (Ohio) Silvery, $18 25@18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $4.65.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 50@15 00; Southern Coke No. 2 Foundry $13 75@14 25; Southern Coke No. 3 Foundry $13 25@13 75; Grey Forge, $12 75@13 25; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $17 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $16 00@16 50; No. 2 Foundry, $15 00@15 50; Grey Forge, $14 00@14 25; White and Mottled, $13 25@13 50; Warm Blast Charcoal, $18 00@20 00; Cold Blast Charcoal $12 00@27 00; Bessemer, $16 00@16 25.

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1½ to 4 by ⅜ to 1 inch	1 80
4½ to 6 by ⅜ to 1 inch	1 90
1½ to 6 by 1¼ to 2 inch	2 20
1¼ & 1½ by ⅜ to ¾ inch	1 90
1 & 1¼ by ⅜ to ¾ inch	2 00
⅛, ¼ and ⅜ by ⅜ to ⅝ inch	2 20

Round and Square.

1 to 1⅜ inch	1 80
2 to 2¾ inch	2 00
2¾ to 3¼ inch	2 10
3½ to 4 inch	2 80
4¼ to 4¾ inch	3 30
4¾ to 5 inch	3 50

Oval.

⅜ to 1¼ inch	2 20
½ to ¾ inch	2 10
⅞	2 60
1	3 00

Half Oval and Half Round.

1¼ to 3 inch	2 90
⅝ to 1¼ inch	2 50
½ to ¾ inch	3 10
⅞	3 30
1	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1¼ by ¼ and 5-16 inch	2 10
¼ to ⅝ by ¼ and 5-16 inch	2 30
to ⅝ by ⅜ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	2 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, 1 and 1⅛, Nos. 13 to 15	2 80
15-16, 1 and 1⅛, Nos. 16 to 18	2 90
15-16, 1 and 1⅛, Nos. 19 and 20	3 00
15-16, 1 and 1⅛, No. 21	3 10
15-16, 1 and 1⅛, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1⅛ to 6 by ⅛ to 3-16 in	2 20
1¼ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅞ and 13-16 by ⅛ to 3-16 in	2 70
⅞ and 1 3-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ⅛ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ⅛ to 3-16 in.	3 30
⅝ and 9-16 by Nos. 11 and 12	3 40
½ by ⅛ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅝ inch, beveled edge, by Nos. 11 and 12	2 80
⅝ inch, " " " 13 and 14	3 00
¾ inch, " " " 11 and 12	3 10
¾ inch, " " " 13 and 14	3 30

Sheet Iron:

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 99
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	¼c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1¼c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅜ and 2¾ to 3 in	10¼
3¼ to 4 in	11
⅛ to 11-16 and 4¼	10¼
⅛ to 6 in	11¼
¼ to 9-32 and 6¼ to 7 in	12
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅜ thick	0

Bessemer and O. H. Steel.

Machinery	base price,	2 75
Tire	"	2 75
Spring	"	3 25
Sleigh Shoe	"	2 75
Toe Calk	"	3 00
Cutter Shoes, tapered and burr.	"	3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	16c

Burden Boiler Rivets.

⅛, ⅜, 11-16 and ¾ inches diameter	4 00
Bridge ⅛, ⅜, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

NET TONS	
No. 1 R. R. wrought scrap	$19 00
No. 1 wrought scrap	17 00
No. 1 Machine cast scrap	12 00
Iron axles	24 00
Axle turnings	13 50
Wrought turning (free from cast)	12 00
Cast borings	8 00
Uncut wrought iron boilers	11 00
Steel boiler plates	17 00
Grate Bars	8 00
Pipes and flues (Clean)	13 50
Tank iron	13 50
Hoop and band iron	10 00
Sheet iron	9 50
Wrought drillings	11 00
Malleable iron	10 00

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00

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MANUFACTURERS OF

SHEET IRON AND SHEET STEEL

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CAPACITY RANGES FROM No. 32 26 INCHES WIDE TO 1-4 x 40 x 120

CAMBRIDGE SOFT STEEL. TRADE MARK

CORRESPONDENCE SOLICITED

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Ball-Norton (Monarch) Electro Magnetic Separator.

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DALLIBA, CORRIGAN & CO.,

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Successors to Tuttle, Oglebay & Co.,

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AND METALS.

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JAS. PATTERSON, Sales Agent.

AULT & WIBORG PRINTING INKS.

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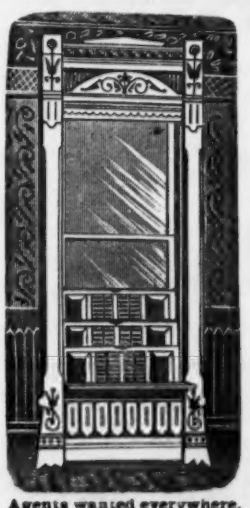
A&W INK USED ON THIS PUBLICATION

Hartman's Patent Inside Sliding Window Blind



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MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned.....dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3¼

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¼".....dis 50&10
Morse Taper and Straight shank Larger than 1¼".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¾c
¼ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6¾c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 50
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5¾	4½	4	3½	3¼
Hexagon	15¾	11¾	8¾	6	5¼	5¼	5
Washers	9	8	7	5	4½	4¼	4¼

In lots less than 100 lbs, ₩ lb add ¼c., 1 lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¾ inch and over.....₩ lb 15¾
Sisal, ¾ inch and over.....₩ lb 13½

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@ 15
" Band.....dis 3 1
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 3 1
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 33c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1850.

Flat head iron.....dis 42&10
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅜ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ⅜ lb Balls (Spring Twine)	11½c	
3-Ply " 1 lb Balls	12@12¾c	
3-Ply " 1½ lb Balls	11@11¾c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 25

Wire.

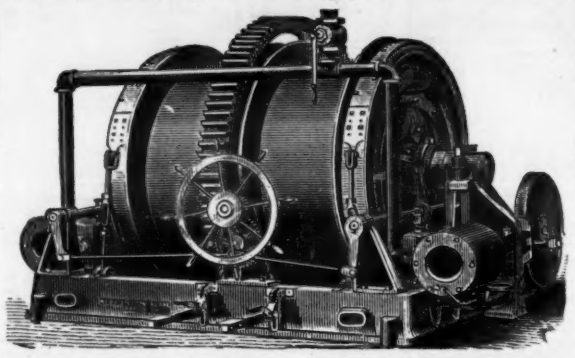
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 5

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 5
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



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Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.

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For Mechanical purposes.

256-260 DEVONSHIRE STREET, BOSTON.

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CLEVELAND, O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS—SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY

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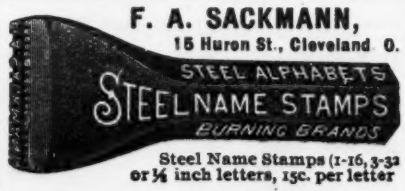

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Detachable Roller and Chain Belting,

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

CHAIN.

For handling materials of all kinds.

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SOLICITOR & COUNSELLOR, City Hall Room 48.

PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.

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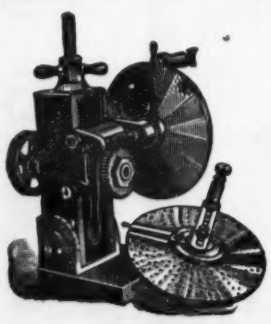

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Or any one having use for SMALL GEARING.

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SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER Co. 201-203 RIVER ST. CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $8 00
Others.....℔ doz $7 00
Full polished.....℔ doz $9 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&10&5
Tire, common, new list.....dis 65
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'.....	$1.25
"A," Stringed Roofing, Light.....	1.50
"B," Stringed Roofing, Medium.....	1.75
"C," Stringed Roofing, Heavy.....	2.00
Stringed, Rosin-Sized.....	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton.....	$30.00
Asphaltum, Fine Grade, ℔ lb.....	.08
Coal Tar Felt, 1 Ply, ℔ lb.....	.02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft.....	1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft.....	1.85
Roofing Pitch, ℔ gal.....	.09

Chains.

Revised List.

Trace, 6¼-10-2.....℔ pair 1.03
Trace, 6¼-10-3.....℔ pair .92 .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ D5¼@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber, Slop, Commode (5 and 5X 14 qt)	6 50	7 50	8 50
2 rs. slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11½ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White corated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 60&10&10@70
Climax, (Anti-Friction).....dis 60
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ lb.	23	24	25	26	28	dis 40
Putnam, ℔ lb.	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hematite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze...dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leves.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@$4.....dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ dos $21 00
Hatch, Tea, No. 161.....℔ dos $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ dos $18 dis 25

Squares.

Steel and iron, Nickel plated.....dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, Oct. 19, 1890.

American iron carpet tacks all kinds dis 77½&10
Steel carpet tacks all kinds.....dis 75&10
Swedes iron carpet tacks, all kinds dis 75&10
Swedes iron tacks.....dis 75&10
Swedes iron Upholsterers' tacks.....dis 75&10
Tinned Swedes iron tacks.....dis 77½&10
Tinned Swedes iron Upholsterers' tacks.....dis 77½&10
American iron cut tacks.....dis 77½&10
Copper tacks.....dis 4[illegible]&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10
Finishing nails.....dis 60&10
Hungarian nails and miners' tacks...dis 60&10
Gimp and lace tacks.....dis 77½&10
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 72½&10
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10

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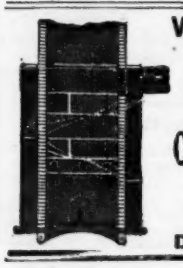

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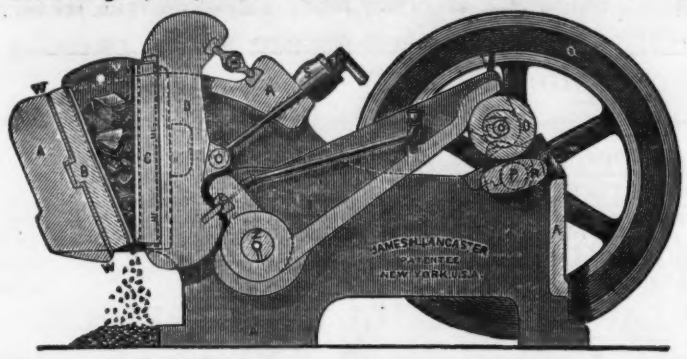

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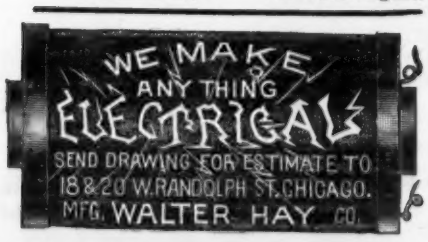

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N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.
(Standard Gauge.)

Depart for—
Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—
Zanesville and Coshocton—10:30 a. m., 6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

Valley Railway.
FOR AKRON, CANTON AND MARIETTA.
Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	7 45 a m	d5 25 a m
	1 15 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	7 45 a m	12 50 p m
	1 15 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.....	3 25 p m	10 10 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. * Except Saturday. Other trains except Sunday.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 00 a m	d 7 00 am
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	1 15 p m	12 50 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	8 00 a m	5 40 p m
	3 25 p m	10 10 a m

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	Depart.
No. 62, Accommodation.....	† 6 05 a m
No. 72, New York & Pitts. Express....	* 8 10 a m
No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 45 p m
No. 73, Leavittsburgh Local.....	* 2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No. 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

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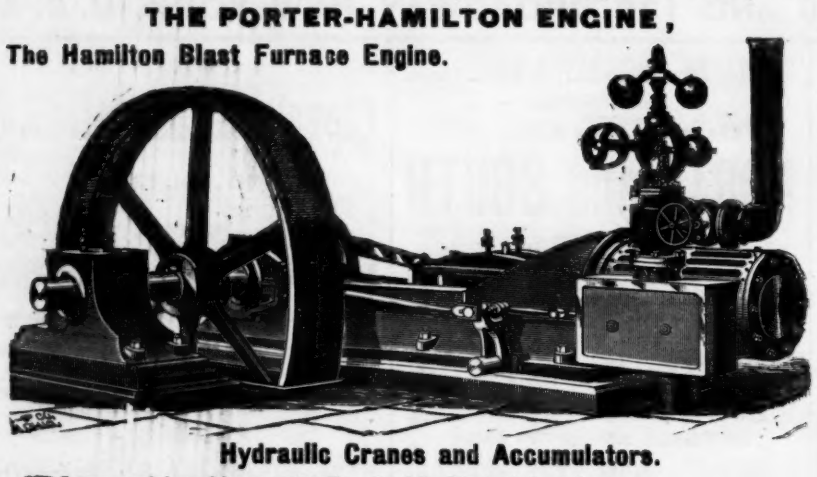

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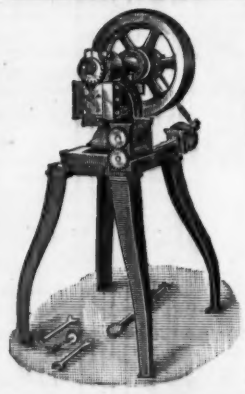

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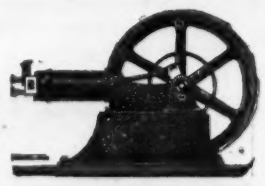

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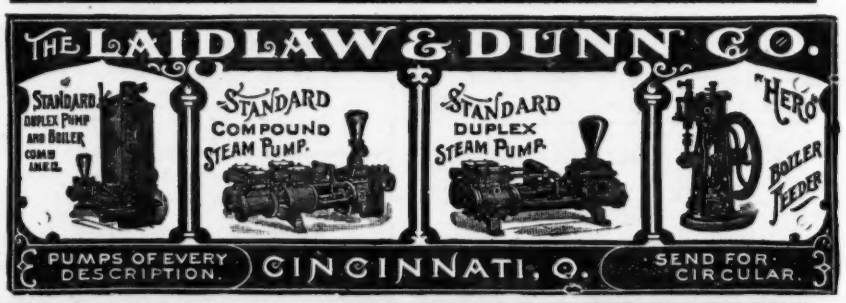

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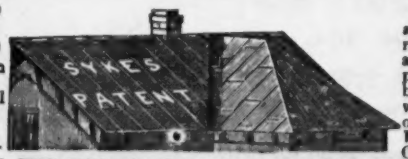

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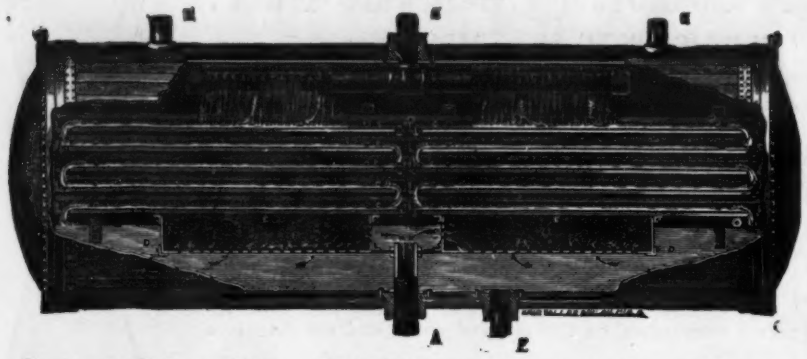

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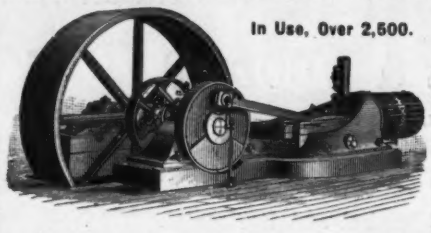

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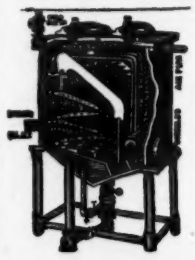

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